THE

ELECTRICAL REVIEW.

VOL. LXVI. FEBRUARY 18, 1910. No. 1,682.

ELECTRICAL REVIEW.

Vol. LXVI.] CONTENTS: February 18, 1910. [No. 1,682.

	Page
The Eight Hours Act	245
Service or Apprenticeship?	246
The Bonus System and Energy Consumption	246
The Future of Electric Traction on Railways	247
Correspondence:—Greenock Destructor—Cinematographs—The Stopping of Lifts—Fire Risks in Buildings—Contractor or Manufacturer?—Methods and Practice in the German Electrical Industry—Protection and the Electrical Industry—The General Election—Protection! From Whom?—The Heurtley Test and Cable-Fault Localisation—The Manufacture of Cement	248—252
Legal	253
Business Notes	256
Notes	262
The Dick Kerr-Bergmann Steam Turbine (*illus.*)	265
A New Electrical Planing Machine Drive (*illus.*)	267
City Notes	268
Market Quotations	276
Stocks and Shares	276
Share List of Electrical Companies	277
Tangyes' Electrically-Driven Pumps (*illus.*)	279
Feeder Pillars for Capstan Control in India (*illus.*)	280
Proceedings of Institutions:—	
Losses off Transmission Lines due to Brush Discharge, with Special Reference to the Case of Direct Current (*illus.*)	281
Physical Society of London	283
Notes on Methods and Practice in the German Electrical Industry	283
New Electrical Devices, Fittings and Plant (*illus.*)	285
Cast-Iron Fittings for Superheated Steam	286
Foreign and Colonial Tariffs on Electrical Goods	287
The Japan-British Exhibition	287
New Patents Applied For, 1910	288
Published Specifications	288
Contractors' Column ... ... Advertisement pages 62 and 64	

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGENTRAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 933; Central 4425 (Editorial only).

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, and has

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each; post free 2s. 9d.

READING CASES, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. TORONTO, ONT.: WM. DAWSON & SONS, LTD., Manning Chambers. Paris: BOIVEAU & CHEVILLET, 22, Rue de la Banque. Berlin: ASHER & Co., Unter den Linden.

Cheques and Postal Orders (on Chief Office, London) to be made payable to Mr. H. ALABASTER, 4, Ludgate Hill, E.C.

THE

UNIVERSAL ELECTRICAL DIRECTORY

(J. A. BERLY'S).

1910 EDITION NOW READY.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE EIGHT HOURS ACT.

As anticipated by those who had even the slightest knowledge of the coal-mining industry, this fatuous—one cannot term it anything else—Act has led to almost absolute dislocation of the coal trade. After six months' working in districts other than Northumberland and Durham, with possibly the exception of Cumberland, the Act has been the means not only of raising the price of coal and reducing the output, but of upsetting the cordial relations between masters and men.

As is well known, a conflict between the coal owners and the men in South Wales was averted just at the last moment, and a stoppage prevented, but the agreement was only looked upon as of a temporary character; and at the moment of writing, the South Wales Coal Conciliation Board is at a deadlock—the owners refusing to concede the demands of the men, who are asking higher wages and payment for small coal, the latter being the introduction of an entirely new custom, as heretofore the men have only been paid on the large coal produced, all that passed through a screen of a certain size of mesh being deducted from the weight of coal sent out. The masters claim that this is necessary to ensure large coal, as their trade depends to a great extent upon the "size" of the coal. This, however, is only one item; it is acknowledged that the men have been earning less wages, and that the output has dropped during the six months ending December last by, we believe, some 12 per cent.; and it naturally follows that if there is less produced there must be less to divide. The miners, however, think they can force the wages up, and the price of coal as well, and were it not for this idea, which as they are now beginning to find out will not work, they never would have asked for an Eight Hours Act. As things are in South Wales there is every prospect of serious trouble, for even if the men's requests are acceded to it must recoil on them to some extent by the closing down of those pits which are expensive to work, thus throwing men out of employment. With the world's supply of coal rapidly developing, no body of men in one country can hope to determine what the price of their labour shall be.

In Northumberland and Durham, where the conditions were so different to other districts that they were given six months extra to make arrangements for the introduction of the Act, which came into force at the beginning of the year, matters are even worse, as at the present moment a large number of men are on strike. The Northumberland men, in fact, have just completed a ballot of the county as to whether the agreement between the Owners and the Miners' Association be terminated or not, the result being a majority in favour of terminating the agreement—or in other words, in favour of a general strike—of 392. Under the rules of the Association, however, there must be a majority of two-

thirds of the total membership, which numbers 35,598, before a general strike can be entered upon. The vote is therefore lost.

In both counties great difficulties were experienced in arriving at a working agreement, and December was well advanced before the agreement between the Durham Coal Owners' Association and that of the Durham Miners was signed; but it was not until close on the new year that the parties in Northumberland came to terms. In Durham the men bitterly opposed the action of their agents in signing the agreement before submitting it to the county, and demanded their resignation. They even went so far as to take a vote of the members to this end, which fortunately, however, showed a majority for their retention. On the other hand, the Northumberland men had the agreement submitted to them, and they voted in its favour, previously to its being signed; and yet when they are asked to abide by the terms many of the men absolutely refuse.

Under the old arrangement, most of the collieries worked under what is termed a two-shift system; that is, there were two shifts of coal-hewers of about seven hours each, and one shift of "lads" (putters, drivers, &c.) of 10 hours, and coal was drawn for this latter period. With the introduction of the Act, however, it follows as a natural consequence that if coal drawing is limited to eight hours, *i.e.*, the "lads'" hours, it will not be possible to draw as many coals; hence, the owners have no alternative but to have two shifts of lads of 8 hours each, and to draw coals for 15 or 16 hours. This means that there will have to be three shifts of coal hewers, each of 6½ to 7 hours each; and it is to this third shift that they object, as it is the "night" shift. This does not necessarily mean that the third shift of hewers will be extra men started at the colliery, as a sufficient number of men for this purpose cannot be obtained, but that the total number of hewers will be divided in three sets instead of two, as formerly. Both men and lads are bitterly opposed to it, and the latter have said that they would much rather work 10 hours during the day than 8 at night.

How the matter will end it is impossible to say; the men now on strike seem determined not to yield, and those at work have only commenced and are working under protest. It is to be hoped, however, that the men will take a more reasonable view of the matter and accept the conditions, as a general strike in the two counties would be little short of a calamity.

In other districts there is more or less unrest, and fears are entertained of a general strike being decided upon to force a settlement of the strike at Clifton Colliery, in Nottinghamshire. Here the cause of the dispute is the refusal of the management to increase the tonnage rate paid in connection with electrical coal-cutting machines. In Lancashire the men's earnings are reduced owing to the lessened working time, and some of the older collieries which were expensive to work have been closed down altogether.

So much for Legislative interference in the conduct of an industry which was admittedly well able to look after itself. It has imposed a serious tax on the general public, caused men to be thrown out of employment, seriously hampered the coal owner in the conduct of his business, and raised a wall of bitterness between employer and employed. It has done no one any good, and the new Parliament could not bring forward a more popular measure than the repeal of this iniquitous Act, to prevent further mischief.

Service or Apprenticeship?

Cases relating to the law of apprenticeship are not now frequent in the Courts, because, alas, apprentices are not so numerous as they used to be. A case was heard on January 21st, however, which draws attention to this important branch of the law. It appeared that a watchmaker at Birmingham employed the plaintiff as a workman at a weekly wage. After he had remained in this employment for a year, the employer was dissatisfied, and discharged him. He subsequently took him on again partly as a servant, in consideration of a weekly wage, and partly to teach him the work of an improver in consideration of a premium. Subsequently, the defendant discharged the plaintiff for alleged idling and insolence, and the plaintiff brought an action for wrongful dismissal, alleging that, as he was an apprentice, no misconduct, however gross, would justify the master's refusal to teach. It was held that the question whether a worker was an "apprentice" or a "servant" was one which had to be considered in the light of all the surrounding circumstances, and that in this case the plaintiff was really only a worker, and could be discharged. Mr. Justice Bray cited the following passage from "Smith's Master and Servant," as a correct statement of the law:—"Formerly it was held that unless the word 'apprentice' was used, the contract might be considered one of hiring and service. But the cases in which that doctrine was laid down have long been over-ruled, and each case is now held to depend upon its own particular circumstances. If the parties appear to have contemplated the relation of master and apprentice, then the contract must be considered as one of apprenticeship, and if it be an imperfect apprenticeship, it cannot be treated as a contract of hiring and service. If, on the other hand, it appear that the parties contemplated the relation of master and servant, then it must be deemed a contract of hiring and service. When teaching and learning appear to be the primary object of the parties, then, although work is to be done for the master, the contract is to be considered as one of apprenticeship. But if working for the master appear to be the primary object, and teaching and learning the master's trade a mere secondary consideration, the existence of a stipulation by the master to teach, and a corresponding stipulation by the servant to learn, the master's trade will not alone prevent the contract from being considered one of hiring and service." This statement of the law appears to accord with good sense; but in order to make assurance doubly sure, it is well so to frame an apprenticeship agreement that misconduct may be sufficient to terminate the employment. Such a proviso is perfectly valid, although the exercise of the power of dismissal may involve an actual loss of part of the premium.

The Bonus System and Energy Consumption.

One of our contemporaries stated a few months ago that a bonus scheme for saving energy had resulted on the Southport Corporation Tramways in the consumption, at the end of the last financial year, being 10,000 units higher than the year before, and that only four drivers had earned the bonus.

We expected to have heard more of this, as it is far from the general experience of tramway managers; and, as one disappointing result may do a great deal more harm to the cause of economy than will be balanced by a number of quite successful experiments, about which little is heard, we consider that the case calls for careful investigation. If the truth be made known, we have very little doubt that the bonus principle will not be found at fault.

THE FUTURE OF ELECTRIC TRACTION ON RAILWAYS.

By PHILIP DAWSON.

A great deal of attention has lately been devoted—both in this country and abroad—to the question of railway electrification.

It is generally admitted by all those who have carefully studied the question that for the present, at least in this country, there is little likelihood of electricity taking the place of steam for long-distance work, although its general introduction for operating suburban lines may eventually be found to materially alter the conditions at present existing, and make a reconsideration of the whole problem advisable.

As is well known, there are three established systems of electric traction at present in use, namely, the continuous, the single-phase and the three-phase system. The latter need not be considered here, as it is generally admitted to be unsuitable for working heavy suburban traffic, for which purpose it has so far never been practically adopted.

The growing importance of electric traction is shown by the fact that last year no less than three papers on this subject were read before the Institution of Civil Engineers, and that they attracted the greatest attention in railway and engineering circles. It has frequently been stated at meetings of railway shareholders and in the technical and lay Press, that progress as regards the growth of electric traction had been seriously delayed by the fact that the L.B. & S.C. Railway had decided to adopt single-phase traction instead of using the better known continuous-current system installed on the Lancashire and Yorkshire, the North-Eastern, and the Mersey Railways, and the Underground Railways of London. The first section of the Brighton Co.'s line, the South London line, to which reference has frequently been made in the Review, was opened for public traffic on December 1st of last year, and unprejudiced observers who have had every opportunity of studying the running of the line, are satisfied that it has so far proved an unqualified technical success, and the company themselves are so satisfied with the commercial results, that immediate extensions are under consideration and will probably be proceeded with at no distant date.

No one can, or would, attempt to deny that, on lines of purely urban character, such as the Underground Electric Railways of London, the continuous-current system has and is giving excellent results. At the same time, the continuous-current system involves the necessity of a third, and frequently a fourth, rail, and presents many other serious disadvantages from a railway engineer's point of view, and furthermore, does not readily lend itself to indefinite extension.

The adoption of the single-phase system by the Brighton Railway has been persistently attacked, frequently by those who should have known better and who ought to have been only too pleased to welcome any system of electric traction which was likely to meet the requirements of railway engineers and managers. It is much to be regretted that "a battle of the systems" should have arisen, as this has greatly strengthened the hands of many railway companies and officials, who were only too anxious to find some excuse for remaining inactive, and many of whom are apparently opposed, on principle, to any modern innovations, preferring to go on in the well-worn grooves of existing steam practice. It would seem that a much more satisfactory course to persue, would be that which has been followed by Continental railways, and particularly by the very shrewd, able and progressive German Government railways, who thoroughly examined the whole question, so as to ascertain what general advantages might be expected from railway electrification. In the case of this country, the advantages to be reaped have been fully demonstrated by the very satisfactory results obtained from the electrified sections of the Lancashire and Yorkshire, and North-Eastern Railways. Under these circumstances it is all the greater pity that many so-called advocates of railway electrification should spend all their time in upholding one system whilst persistently attempting to wreck a new system, the advantages of which are patent to every disinterested railway engineer.

The single-phase system as a practical one, only dates back a few years, and considering the short time it has been in existence, the progress made is really remarkable. It first came into being when tramway competition had so seriously damaged railway traffic as to make the introduction of a new motive system on railways a practical necessity, unless the railways were prepared to entirely and for ever relinquish all chance of catering for suburban traffic.

The single-phase system was a result of the conditions imposed by most railway authorities, and its development was only rendered possible by the enormous progress made in traction-motor design in consequence of the wonderfully rapid growth of electric tramways, and the subsequent development of the underground and elevated electric railways in Europe and the United States.

The principal development of the single-phase system as applied to existing railways, has undoubtedly taken place in Europe.

It is, therefore, instructive to read in the review of the year published in the well-known German paper *Elektrische Kraftbetriebe und Bahnen*, the very strong and authoritative statement there made in this connection. But before reproducing the paragraph referred to, it may be as well to note that this paper is produced with the co-operation of a publishing committee, amongst whom are numbered such important names as :—

Geheimer Oberbaurat G. Wittfeld, the chief engineer of the Minister of Public Works in Berlin, under whose department all the railways are run; Prof. Doct. Geheimer Baurat R. Ullricht, the chief engineer of the Sachsen Minister of Finance; Oberbaurat W. Stahl, of the State Railways of the Grand Duchy of Baden; Dr. Oberregierungsrat B. Gleichmann, chief engineer of the Bavarian Minister of Railways, and many other important public and private officials.

The paragraph referred to in the review of the year, which is published with full editorial authority, and is not simply the opinion of any one individual, therefore carries with it exceptional weight, and reads as follows :—

"The satisfactory results with single-phase currents have resulted in its having been decided to only consider this form of current in all further traction installations which will be made in the Prussian and Hessian State Railways." Furthermore, all the other German railway authorities, who are considering electric traction, as far as both long-distance and urban (Fern und Vorortbahnen) railways are concerned, have decided to adopt the single-phase system.

There is little doubt that any unbiased railway authority which would set itself to thoroughly and seriously consider the general question of electrification, would arrive at the same conclusion, and this contention is supported by the fact that the Swiss and Swedish railways, as well as the Chemin du Fer du Midi, in France—which latter is now equipping some 320 km. of suburban as well as long-distance lines—have all decided in favour of the single-phase system for all purposes, both urban as well as long distance.

The case of L.B. & S.C. and the Midland Railway is too much before the electric and railway world to need any reference in the present case.

It should, furthermore, be noted that in England, the Continent of Europe and the United States of America, all the main line railways which have adopted the continuous-current system did so before the single-phase system had become a practicable possibility.

Exaggerated importance has been attached by some to the fact that a few single-phase lines which have not given entire satisfaction in the past, have been altered to continuous-current working, and it may, therefore, not be without interest to examine the particular circumstances which have produced such results.

Practically, without exception, all the unsatisfactory single-phase systems referred to by its opponents are to be found in the United States of America. It is true that the Seebach Wettingen line in Switzerland has ceased to be worked by electric locomotives; in this case, however, it must be remembered that the line was only equipped to gain experience in connection with the intended electrical equipment of many of the Swiss Government main lines, such as the St. Gothard line. There could be no other object in equipping such a short line as the Seebach Wettin-

gen line, and once the Government was satisfied, there was no reason to continue the electric service.

The result of the Seebach Wettingen experiments has been that the Swiss Government has decided that the only possible system for electric railway traction is the single-phase system.

We now come to the many American examples where undoubtedly the single-phase system has not given satisfaction. Fortunately there is, and can be, no doubt in the minds of those who are cognisant of the conditions obtaining in these cases, of the real causes which brought about such a result.

In every case, without exception, on the American lines the systems installed were not purely alternating ones, and in most cases were not what would be called main line railways in this country, but purely electric interurban lines. The cars ran on alternating current, whilst outside towns; whereas inside the many towns they traversed they had to run over existing tramway systems operated by continuous current of from 500 to 600 volts. Therefore the equipments had to be such as could be operated either with high-pressure single-phase currents at from 3,000 to 11,000 volts, or with 500 to 600-volt continuous current. The result could have been foreseen if sufficient care and pains had been taken originally when these lines were projected, and if the single-phase enthusiasts had not claimed too great virtues for the new system and attempted to do too much.

In Europe, on the contrary, the preliminary investigations of railway engineers, and subsequent experience, has confirmed the conclusions they originally drew, showing that only complications and possible failure could result from attempting to produce and operate a single-phase equipment, particularly for heavy railway work and in connection with multiple-unit control, which should run with both single-phase and continuous currents. As a consequence there is not one single example to be found in Europe of a single-phase main line railway operating over both continuous and alternating-current systems. The European railway engineers and manufacturers concentrated all their attention on producing a first-class single-phase equipment, whereas in America the contrary was the case, attention being principally concentrated on producing a very good continuous-current motor which should be capable of operating with alternating current. The results which have been obtained were only to be expected.

The Baltimore and Annapolis line has its cars running for a considerable distance through the streets of Baltimore and other towns over lines operated with 500 to 600-volt continuous current; it is not a railway in the strict sense that we give to the term here, and cannot be compared as regards conditions to be filled, with either the L.B. & S.C. Railway, or the Hamburg-Blankenese line, and the reasons for its conversion to 1,200-volt continuous current are obvious.

By using 1,200 volts between towns, and 600 volts in towns, the same motors by groupings of parallel and series can be made automatically to fulfil the conditions of speed required in and outside the towns, without the very great complications and additions to weight which are inseparable from any dual system. Exactly similar remarks apply to the conversion of the Milwaukee Street Railway, from single-phase to continuous working. Careful investigations show that in practically all the cases where any difficulty has been experienced with single-phase working, it is due to the use of a mixed system, and, furthermore, that without exception all failures or reported serious troubles have been limited to the United States, which is so far the only country where the dual system has found any considerable application.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Greenock Destructor.

It is a pity "N. B." did not allow himself nine months to think out a crushing reply to my letter, instead of only two weeks; anyway, he should have read his letter over before sending it away. First he states that Mr. Robertson, of Greenock, is *bête noir* to myself; then he changes his mind, and hints that it was because I was overshadowed by a newer, larger and more notable (*sic*) destructor. After the above two reasons, "N. B." is still not satisfied, but exclaims that my belated communication was written for extraction, transmission and advertisement purposes. "N. B." should really have made up his mind as to which of the three charges he was going to rub in, as now I shall have to reply to all three.

1. I do not know Mr. Robertson, and to my knowledge have never seen him. However, everything I have heard concerning him has been distinctly to his advantage. This being the case, he cannot be *bête noir* to myself—rather the contrary.

2. As to Greenock destructor overshadowing Cambuslang "village" destructor, I consider that it is quite the other way about, and give figures in my letter to prove it. The "village" destructor has also been visited, praised and copied by engineers and deputations from all parts of the world, and if "N. B." would come here it would add considerably to his knowledge of destructors, which from his letter seems rather scanty.

3. The third charge is quite a cowardly and contemptible one to make, and probably accounts for the reason why "N. B." has not the courage to write under his own name. He should, however, be very careful of making such statements about anybody.

Regarding Greenock destructor, I can assure "N. B." that it would be quite impossible there to keep steady steam or load unless coal-fired boilers were in parallel with the destructor boilers, and I challenge Mr. Robertson to do so next summer, when he can shut down the coal-fired boilers in this station. This will also give Mr. Robertson an opportunity of proving exactly how many units per ton of refuse he can get—a matter which so far has only been calculated. I would, in conclusion, recommend "N. B." to lay aside his French Dictionary and study the *Electrical Times* table of costs, where he will find the following :—

	Units sold.	Works costs per unit sold.	Load factor.
Greenock (June, 1909) ...	3,495,852	0·61d.	17·20 %
Cambuslang (May, 1909)...	102,871	0·62d.	9·95 %

Cambuslang costs will be a lot lower for the year ending May, 1910.

A. J. Abraham.

Electricity Works, Cambuslang,
February 12th, 1910.

Cinematographs.

I notice the letter from your correspondent "Uniformity" in your issue of February 11th, respecting the Regulations for cinematograph entertainments issued by the Secretary for Scotland, which Regulations appear to be similar to those issued by the Home Office on January 1st last.

Your correspondent appears to be under a misapprehension respecting the use of resistances under Clause 4 (*c*), and, as I have received numerous communications from other persons who have taken the same view of the Clause in question, I think it advisable to bring to the notice of your readers the following explanation :—

A provisional draft of the Regulations was sent to me from the Home Office on December 7th, and included a rule that no cinematograph circuit should be used at a higher pressure than 110 volts. The following is an extract from my reply :—

"If this clause is allowed to stand, a serious obstacle will be placed in the way of a great number of travelling exhibitors who are at present accustomed to take their supply from circuits of from 200 up to 240 volts; it is almost impracticable for them to use a rotary converter or transformer to reduce the pressure to 110 volts.

"I am entirely at a loss to understand how safety would be increased by such a regulation. If this clause were so altered as to limit the working pressure between the leads entering the operator's enclosure to 110 volts, the difficulty would be overcome; any required additional resistance could then be placed outside that enclosure."

The clause objected to was then altered in the Regulations, as issued, to the following :—

"No current at a higher pressure than 110 volts shall be used within the enclosure."

Your correspondent will, therefore, understand that his resistance may be placed outside the enclosure, and, providing that the working pressure between the leads entering the enclosure does not exceed 110 volts, he will be conforming with the Regulations, in spite of the fact that the open-circuit voltage may be 220 volts, or higher. The object, of course, is to exclude large and hot resistances from the neighbourhood of the inflammable film.

In anticipation of such Regulations I designed some special resistances, which were described in your columns in your issue of April 2nd, 1909. In addition to conforming with all the new Regulations, they have the advantage that they may be controlled by the operator inside the enclosure, and these resistances are now being used by the principal companies running electric theatres throughout the country.

In the event of your correspondent having any difficulty with the local authority respecting the interpretation of the Regulations, I suggest that he should bring the matter to the notice of the Cinematograph Manufacturers' Association.

R. W. Paul.

London, N., *February 14th*, 1910.

With reference to the letter signed "Uniformity" appearing in your last week's issue, the Regulations to which he refers are evidently those issued by the Secretary for Scotland under the Cinematograph Act, 1909. I have not had an opportunity of seeing these Regulations, but they appear from the extracts he gives to be similar to those issued towards the end of December by the Secretary of State under this Act as applying to England, of which your correspondent does not seem to be aware.

The Secretary of State has already been approached by certain representative members of the cinematograph trade, and it appears that the Regulation with regard to a maximum pressure of 100 volts across any apparatus in the projecting chamber is intended to apply to the said apparatus while the arc is in circuit and not while the arc is open. It would, therefore, seem that a pressure up to even 440 volts may be used so long as the main resistance is situated away from the operating chamber; a small regulating resistance is allowed in the chamber itself, provided that the pressure across this small resistance, together with the lamp, does not exceed 100 volts. In issuing the Regulations, it seems to have been overlooked that the adjustment thus permitted allows a very small margin between the starting current and the full-load current, as, even if the supply pressure is only 150 volts, the current cannot, under the Regulations, be cut down to less than one-half the full-load current without raising the P.D. across the lamp and resistance to above 100 volts, while, if the supply pressure is above 150 volts, only a very small range of regulation can be obtained, and this range diminishes as the pressure increases.

The best course, and one which can easily be followed, is to have the whole of the resistance right away from the operating chamber.

Your correspondent touches upon another point with regard to the internal lighting of the operating box. Exactly the conditions he refers to existed in an important London hall; the cinematograph circuit was on a 100-volt supply, while an incandescent lamp over the machine was on a separate 200-volt circuit. An inspector objected to this arrangement under the new Regulations, and this fact was brought to the notice of the representative of the Secretary of State, who informally stated that the Regulation in question was not intended to apply to a case of this sort, and promised that the rule would be modified.

Ernest F. Moy, Ltd.
E. F. Moy, *Managing Director.*

London, N.W., *February 15th*, 1910.

The Stopping of Lifts.

I notice in your issue of January 28th a letter in which Mr. Rosenbusch endeavours to give the impression that the subject matter described in my article on "The Stopping of Lifts" is really ancient history.

If such is the case, how is it that so many push-button lifts are provided with "inching" buttons for adjusting the cage to floor level, or with complicated devices for putting the cage on slow travel some time before the actual stopping mechanism comes into action?

It is perfectly true that as early as 1902 the firm with whom your correspondent is connected had a method of automatically varying the braking resistance, but the variation has to be made while current is passing through the resistance and its switch contacts, whereas the method described in the article adjusts the value of the resistance before the regenerative current begins to flow, and also the variation effected follows more exactly the correct law for the purpose.

It is exactly on this question of the employment of "primary principles" that your correspondent misses the point of the article, for it is certain that there is no more direct electrical method of measuring the torque developed by a shunt motor than to measure the current passing through its armature. This is much more direct than measuring the change of back E.M.F. arising from a change of speed caused by introducing a fixed resistance into the armature circuit, which is the basis of the method described in the above-mentioned patent of 1902. It is perfectly true that the rotating parts carry by far the greater store of kinetic energy, and disasters have arisen from attempts to shorten unduly the time of its absorption by means of heavy mechanical braking following an incorrect law.

The writer has known of the shaft ends of motors being twisted off by over-zealous application of the mechanical brake, where the motor-armature was of such form as to act as an efficient fly-wheel.

The ideal arrangement is that the armature should absorb by dynamo-action the whole of its own kinetic energy, and that the mechanical brake should take up that of the brake-pulley and other mechanical parts, thus relieving the neck of the motor shaft from all braking stress.

The method advocated by your correspondent gives rise to a sudden reversal of stress in the motor shaft, which would quickly be disastrous if it reached any considerable magnitude. It is very doubtful, however, if the effect of the mechanical brake during stoppage is really eliminated as indicated by his description. It would not, in fact, from the safety point of view, be a wise policy so to eliminate it, for it would make the whole stopping operation depend upon the continuity of an electric circuit which includes automatic switch contacts.

F. O. Hunt.

Newcastle-on-Tyne,
February 7th, 1910.

Fire Risks in Buildings.

With reference to the letter by "Lamps" under the above heading, in my opinion the fault lies with the extreme fragility of the filaments, which break when the lamp receives a slight knock and then join together again, very often making the filament considerably shorter.

When the current is switched on the usual over-shooting takes place, but being much greater, by reason of the decreased length of filament, the wires leading into the lamp through the glass stem are fused, causing the glass stem to crack; and in some cases the bulb bursts.

I think the cause of the fire following, is the falling of hot globules of metal on inflammable material. These globules fall from the leading-in wires, which are of larger diameter in metal-filament lamps than in carbon. It would be of great benefit to the industry if the metal-filament lamp were standardised.

Lampmaker.

Contractor or Manufacturer?

Mr. Watson's letter in your issue of the 4th inst. moves me to urge on the various parties in this controversy that no advantage can be gained by such correspondence.

We have come to a critical stage in the history of electric supply, due to the question of what is to be the future policy of electric supply authorities in increasing business.

Contractors must recognise that it is hopeless for, say, 12 men in one area to attempt to control for their own personal advantage a large business like electric supply, which must be run in the interests of thousands of ratepayers. On the

other hand, the managers of supply undertakings should not go out of their way to injure the business of any of the tradesmen in their area, if this can possibly be avoided without materially interfering with the interests of their undertakings.

It is unnecessary to go into details in this matter, but generally it can be agreed that misunderstanding is probably at the bottom of a great deal of the trouble.

I am still of the opinion that a meeting between, say, the Municipal Electrical Association and the Contractors' Association might possibly lead to a more satisfactory state of affairs; anyhow, little could be lost by such a course. Reasonableness and recognition of the interests of the opposite side are necessary adjuncts in approaching this matter by both parties.

Whether one agrees with public authorities undertaking electric supply or not, when such a business is already under their control, it is the duty of the employés of that department and the ratepayers to carry on the business to the best of their ability to make it a commercial success.

My own attitude in this matter originally was that the contractors should, as far as possible, have the work left in their own hands, but I must confess that the behaviour of a large number of even prominent contractors during the last year or so has considerably weakened my position—probably my experience has been similar to many others. Contractors consider that if they cannot get some advantage by approaching the manager, they may do so in their position as ratepayers, bringing pressure to bear on members of the committee.

The present condition of jealousy and strife amongst the various contractors in obtaining work is regrettable. There is no doubt that the work is insufficient to go round, and the contractors seem to think that the Publicity Department of the Supply Undertaking has the duty of finding sufficient work for all the contractors to keep them fully employed.

I have given this matter a considerable amount of thought, and must confess that the conclusion I am coming to is that the supply authorities will have to take in hand a much more vigorous policy of business development than they have done in the past. There is such an absolute want of logic in the present relative positions of gas companies and electrical undertakers, that I am sure, as time goes on, the supply authority will find itself forced in many cases to go against probably its own inclination in taking up the work of hire and hire-purchase of motors, installations, &c., and the sale of electrical apparatus. Perhaps the Contractors' Association might, in the interests of their contractors, be able to make some reasonable arrangement through the medium of the Municipal Electrical Association. Failing this, it seems to me that the future policy of supply undertakings is quite clear; the business of electric supply in this country is far too important to be jeopardised by continuance of the present crude and elementary commercial handling.

I think it will be generally conceded amongst supply managers that in running a sales department there should be no cutting of prices, but there are, of course, as in the case of any business, points on which there may have to be exceptions to the general rule.

The attitude of the contractors is a strange anomaly. They profess to be on good terms with the supply managers, but go behind their backs to sow strife and dissatisfaction in the minds of the committee men. It is to be hoped that all managers will see that such tactics are vigorously fought and promptly squashed.

Alex. C. Cramb.

Electricity Works, Croydon,
February 8th, 1910.

Methods and Practice in the German Electrical Industry.

I agree with "Zähler" that the subject about which we have been corresponding is an inexhaustible one, and it therefore becomes desirable not to shirk issues.

In my first letter I dealt with the question on general lines. "Zähler" replied, suggesting that I should be more interesting if I gave information on a subject of which I had intimate knowledge. I responded to his request by giving some particulars of meter business, which he now carefully ignores, and charges me with arguing from the particular to the general. I did nothing of the sort. I merely stated facts which he can neither controvert, nor explain, as being in consonance with his theories. "Zähler" prefers to argue from the general to the particular. That is precisely what I challenged him to do in the concluding paragraph of my last letter.

I have yet to meet the free importer who can give one concrete example of free imports stimulating taxed exports. If there is in either of "Zähler's" letters an argument in favour of importing goods which displace our labourers, I should like it pointed out. I entirely deny that tariffs would increase the cost of various parts of meters. As "Zähler" himself points out, in the case of the completed article, it is internal competition which fixes the price. Will "Zähler" kindly explain how it is that we are met with the very keenest competition in every market of the world, including our own, from these Protected countries, which presumably should suffer from "duties upon copper wire, iron stampings, steel magnets, dial counter mechanisms, brass and iron castings, &c.?"

I have already declared from my own intimate knowledge that meters are sold as cheaply, and more cheaply, in the Protected markets than they are here.

A. Bruce Anderson.

Hollinwood, Lancs.,
February 8th, 1910.

Protection and the Electrical Industry.

In an endeavour to be brief, I assumed certain readers to possess an elementary knowledge of international trading. I will, however, refrain from making any such assumption in future.

Goods are exchanged for goods, and they always have been. Primitive man started business by bartering, but the process of exchange being rather clumsy, his descendants introduced various systems by means of which the exchanges could be effected at greater convenience. Shells, metals, and even oxen, have at different times been used as bases of exchange, and the present monetary system is simply the most convenient system that has been evolved to facilitate trading. The fundamental fact, however, still holds good, viz., goods pay for goods. Therefore, if, as Mr. Hecht suggests, we keep out imports, we are bound to lose in exports.

I contend that it is impossible to keep out manufactured imports. Germany and America have been endeavouring with high import duties to keep out the foreigner, and a study of the following figures shows that they have not even succeeded in keeping imports at a standstill.

The figures quoted are the official returns of manufactured imports in millions of pounds:—

	Germany.	*U.S.A.*	*U.K.*
1902	54·2	78·9	115·5
1903	59·3	94·5	116·3
1904	60·0	86·0	115·7
1905	65·2	89·6	121·4
1906	82·3	110·0	130·2
1907	88·1	132·9	127·9
1908	75·6	110·0	119·8

If America, with an average import duty of 50 per cent. cannot keep out manufactured imports, how can we expect to keep out manufactured imports with a duty of 10 per cent.?

Now, with reference to Mr. Rendell's letter, he implies that exports are only of value if they go to Germany or America. Is he ignorant of the fact that our British possessions are protected, as also are Brazil, the Argentine and Japan?

Again, has Mr. Rendell ever studied any figures relating to retaliatory wars? With my superficial knowledge, I can refer him to the trade of France and Italy in 1888. France started by putting heavy duties on Italian imports—silks, wines, &c. Italy retaliated by putting heavier duties on French woollens. French exports to Italy fell from 13 million pounds to 5 million pounds, and Italian exports to France fell from 12 million pounds to 5 million pounds. Neither country benefited by the struggle, as their competitors stepped in and took the trade. In 1903, Germany, resenting the preference given to British goods entering Canada, raised the duty against Canadian produce entering

Germany, and Canada immediately retaliated with a 33 per cent. sur-tax on German goods. In spite of these facts, the Tariff Reformer thinks that by putting a duty on incoming manufactures, we can force the foreigner to lower his duty. If we put an import duty on German electrical goods, Germany can and will retaliate on our exports to Germany, such as textile manufactures, of which alone we sent roughly 10 millon pounds value in 1909, receiving very little of the same manufacture in exchange.

I do not propose to continue this discussion, and I am heartily in agreement with Mr. Rendell when he advocates an impartial inquiry. Should any of the Tariff Reformers, however, desire to have the "last word," I will ask them to prove that my statements and deductions are incorrect, and to set out a scheme of Tariff Reform, based on official trade returns and a comprehensive knowledge of international trading, showing clearly that the United Kingdom will gain by such a system.

Free Trader.

"Ex-communicated" asks me to bet him a level £5 that he has made a false statement. I showed that his profits were abnormal, if his statements were correct; as he has not stated what goods he manufactured, I stated the average German, American and Russian duties on all manufactured imports; but I am quite ready to take a typical case, viz., a 100-H.P. continuous-current electric motor, weighing 3½ tons, price f.o.b. for any market £156 = say £45 per ton :—

German import duty	...	50 marks, say £2 10s., per ton.
French "	...	300 francs, say £12, per ton
American "	...	45 % *ad valorem*, over £20, per ton
Russian "	...	518 roubles, say £55, per ton

This is very different from "Ex-communicated's" mysterious manufactures, taxed about 4 per cent. in Germany, about 10 per cent. in France, and about 8 per cent. in Russia, as he now states. As he says, he pays these duties, it is clear he has a very abnormal profit on his sales in free markets.

His statement that in 20 years of exporting, he has found ONE case where a manufacturer refused to quote until the country of destination was stated, confirms my statement (based on 26 years of exporting) that usually manufacturers make the same price f.o.b. for all markets.

A net profit on sales for export of 2 or 3 per cent. is quite consistent with a good dividend on working capital, as most export business is done on cash terms and is free from risk; but so long as a manufacturer is making any net profit at all, he is not likely to go into the Bankruptcy Court, and it is not clear why "Ex-communicated" thinks he deserves to do so.

The preceding letter by Mr. Rendell gives evidence showing that although our electrical exports are double our electrical imports, our exports to Germany and America are much smaller than our imports from those two countries. But, surely, it is natural that the chief buyers of our electrical goods should be those countries who have little or none to sell to us. I presume Mr. Rendell sells nothing at all to his baker, butcher, tailor, &c.; but would he on that account like to be taxed on everything he buys from them?

Protectionists ask us to return to the political interference with trade, from which we freed ourselves after full experience of its evils. The more we observe the effect of Protection abroad, the more we are likely to value our freedom.

February 12th, 1910.

C. E.

A most disconcerting result of the Tariff Reform campaign is the complete degradation of the terms of economic science. These terms are unfortunately words in common daily use. The non-economist, hearing these common words, at once jumps to the conclusion that he knows what they mean, and that the science only requires an application of common sense to his daily experience.

Take, for example, the expression "mobility of capital." In economics, the term refers to the fresh capital which the savings of the nation offer each year for investment in the most attractive directions.

Not that capital sunk in bricks and mortar and in machinery is permanently "fixed," for a 10 per cent. depreciation fund will wipe it out in 10 years, and a modest 3½ per cent. in 30 years. The corresponding phrase, "mobility of labour," does not (in economics) refer to the present body of trained artisans, but to the fresh supply of young people which comes forward each year for apprenticeship to the trade or profession which seems most attractive at the time.

Once the plastic years of youth are passed, it is true that specialised skill can be transferred in bulk only to similar industries. But such skill is not more permanently "fixed" than "fixed capital."

Life tables tell us what is our average expectation of life, and when we may expect Nature to write off finally our knowledge and skill.

A single generation is sufficient time for the complete movement of our population from the industries of one generation into the industries of the next, without any transfer of individual artisans from one class of skilled labour to another. Less time probably sees old mechanical appliances scrapped and replaced by machinery new and up to date for the time being.

How different is this dry statement from the lurid suggestion of Tariff Reformers that labour is mobile only when the artisan becomes a dock labourer, and unloads the foreign goods which deprive him of skilled employment! (See Mr. J. Chamberlain *passim*.)

One wonders how the international accounts will stand when we are all dock labourers, and the foreigner accepts the services of unloading in full payment of the cargo itself!

Your correspondent, Mr. T. C. Elder, offers another example of this degradation of economic terms, in his use of the word "Protection."

Protection will come, he says, while these cocksure Free Trade Hotgospellers, who know everything about international trade, argue.

One party will give it in the shape of Patent Acts and bounties, and so on.

Bounties, it may be remarked in passing, are not supposed to be paid by the foreigner even in Tariff Reform circles, and as Mr. Elder is indifferent whether we get bounties or protective tariffs, we may note with satisfaction that he, at least, does not believe the Birmingham myth that import duties are paid by the foreigner.

But to return to Protection and Patent Acts. Mr. Elder's argument stripped of rhetoric may be supposed to run as follows :—

Protection means more employment.

The amendment of the Patent Law means more employment. Therefore, the amendment of the Patent Law is Protection.

If memory serves, this is known to formal logicians as the fallacy of the major premiss, and Mr. Elder may be supposed to have dropped into this fallacy from having prejudged the conclusion.

A more careful analysis of the point would be as follows: The old Patent Law gave monopoly right for a limited number of years in return for the publication of the fruits of the patentee's brain, on the principle that the country gained more by the publication than it lost by the subsequent restriction for a number of years.

The law is now amended to refuse these monopolies to holders of patents, published and manufactured in other countries and published, but not manufactured, in this country.

The amendment is, therefore, in the direction of removing restrictions on trade, and is in no sense a protective measure, and in every sense a step towards Free Trade.

It would be misusing terms, however, to say that all Patent Law is of the nature of Protection, merely because it restricts the free flow of trade *subsequent to publication*.

Only if publication could be ensured without privileges being granted in return, would Patent Laws be measures of pure protection.

After such inroad on your space it would be audacity to propose the discussion in detail of the points raised by your many correspondents. To answer them in the sense of giving verbally smart rejoinders, I am neither willing nor able. Yet I must try to give poor Cobden's ghost a hope of rest.

Cobden was not the last of the economists. The number of works written on economic problems by men trained for their study, grows from year to year.

A mere catalogue of such works produced in the period 1873-1903, would well fill several of your weekly issues, advertisement pages and all!

Yet some of your correspondents repeat that Cobden is out of date, and imply that *therefore* economic science is out of date.

Another correspondent grants that prices will rise all round under a tariff, and considers such a rise beneficial.

It is to be supposed that a really scientific tariff (if such were not statistically impossible for tens of thousands of diverse businesses) would raise the cost of every operation performed in this country by exactly 10 per cent., or whatever the chosen percentage might be.

But it is exchange values that are of practical importance, not values with reference to a comparatively rare standard medium such as gold.

So that the home market would be left where it started.

Again, how this legal inflation of "gold" prices is to help the export market is just the question that Lancashire asks of Tariff Reform.

"H. S. H." accepts my analysis of the primary benefits of Protection to the protected industry, but ignores my request for a satisfactory method of estimating the secondary, tertiary and ultimate reactions; that is, he ignores the real difficulties of the question, and the *whole* case for free imports.

Like the late Richard Sedden, he wants more gold imports. I should like to make him eat gold, drink gold, and wear gold, until he realises that gold is only a convenient common measure, and that we only want enough of it for conveniently measuring prices in this country. So far from advising him not to become an economist, I advise him to buy Bagshot's "Economic Studies," in the Silver Library series, and Ashley's little 4s. 6d. book, "Trade and Tariffs," I think it is called, and to begin his economic studies at once. Then, if we do not agree, we shall at least understand one another.

It is the debasement of the currency of economic language which creates the difficulty your correspondent, Mr. Kingsbury, complains of.

Tariff Reformers insist on employing the debased coinage of the Birmingham mint.

We cannot have profitable intercourse with them, if we still prefer the strict term evolved by generations of economists, to the piebald politico-economic term, whose colour changes from town to town, and from mouth to mouth, and whose meaning is different in the same mouth from day to day.

The excuse offered is the necessity of explaining economic science on the popular platform.

The necessity is not apparent.

A Royal Commission may yet render supererogatory the self-imposed labours of the notorious Tariff Reform Commission.

A. R. Low.

Loughborough, *February 12th*, 1910.

The General Election.

The General Election of 1910 is unique, inasmuch as people of all shades of political thought profess to be pleased with the result. This satisfaction is shared by the writer of your leading article, but he is hardly correct in stating that "the result is a drawn battle, the draw being in favour of Free Trade"—"Free Trade" meaning, I suppose, the existing system of Free Imports and Taxed Exports. The writer has overlooked the fact that the Molly Maguires and the Brienites are Protectionists to a man. Assuming there is no change in the representation of the seats still unpolled, the new Parliament will consist of 355 Tariff Reformers and 315 Free Importers. In these figures I have given the whole of the Labour members to the party of *laisser faire*; but to paraphrase Mr. Hecht's question, *Can* a logical Trade Unionist accept the position of unrestricted foreign competition, while the fruit of his own labour is shut out from the home markets of the competitors?

E. P. Allan.

London, W.C., *February 8th*, 1910.

Protection! from Whom?

I would not have troubled you again, but that the "Writer of the Article" misrepresents me, no doubt unintentionally. The subject should be treated as a whole, and the only reliable way to get the consensus of opinion of "the trade" would be by the appointment of a properly constituted commission representative of the whole industry.

I am not good at figure juggling, but am still able to judge of cause and effect. The census of production returns are of very little real value.

I am not in favour of keeping out or even taxing that which is undoubtedly best made by the foreigner (everything else being equal), but I still believe a scientific tariff would assist the electrical manufacturer at home, where it prevented the dumping of goods to be sold at manifestly their cost or under, for the purpose of ultimately securing the market.

On one point at least I am in hearty agreement with the "Writer of the Article," for I also am quite satisfied that the opinion given by the manufacturing section of the country is in favour of a Tariff, as evidenced by the larger number of votes given, and this on a first showing.

My *nom de plume* was suggested by your heading "Communicated," and has no other or hidden meaning as far as I am concerned.

Ex-communicated.

The Heurtley Test and Cable-Fault Localisation.

Regarding a query in Mr. Heurtley's letter in your issue of the 11th inst., I am sorry that the original readings, obtained by a friend at my request for tabulation in the Electrical Review article of November 19th, 1909, are not available. I cannot, therefore, give the final results of tests 4 and 5 referred to by Mr. Heurtley. At the time I thought the final results embodied in graph, fig. 52, from my own tests were sufficient. I quite appreciate Mr. Heurtley's point, and I regret that the figures he pertinently seeks are not to hand.

The writer hopes shortly to have an opportunity to put Mr. Heurtley's suggestions into practice, especially in arranging bridge connections for the Heurtley test, so that the testing current would traverse artificial and real exposures connected in series with each other, in one and the same direction.

Mr. Heurtley's welcome comments on matters raised by the writer's presentment of the *exposure* test will be included as an addendum in the booklet reprint—now in press—of "Cable-Fault Localisation Graphs in Practice," shortly to be brought out by Messrs. H. Alabaster, Gatehouse & Co.

E. Raymond-Barker.

Wimbledon, *February 14th*, 1910.

The Manufacture of Cement.

In your article on the Coltness cement plant in your issue of the 11th inst. you give an explanation of the chemistry of the "Collos" process, which, to quote von Humboldt, savours of pre-historic times. I refer to the paragraph on page 221, starting:—"The molten slag in a condition of high incandescence, &c." One does hardly know which to admire the most, the badly concealed translation from the German, or the original writer's opinion of the state of science in this country. How can you "impregnate" molten slag with an aqueous solution? There is no surface tension between the two. What is a "catalising" reagent? It is a phrase invented by Berzelius to cover his own ignorance, and it died a natural death with the coming of physical chemistry. The question of the removal of sulphur by "acids" in a state of "nascence" reminds one of Paracelsus, it is certainly "bombastic." In this country it has been known for years that steam decomposes calcium-sulphide most easily, yielding sulphuretted hydrogen and lime, somewhat after the following formula:—

$$CaS + H_2O = CaO + H_2S \quad \ldots (1)$$

The H_2S immediately burns in the surrounding air, thus:—

$$H_2S + 3O = H_2O + SO_2 \quad \ldots (2)$$

Claus, Hargreaves, and others showed the use of this reaction in connection with alkali waste, and Passow, knowingly or

unknowingly, utilised it for treating blast-furnace slag. Personally, I have removed 70 per cent. of the contents of sulphur in a blast-furnace slag by passing superheated steam over it at orange heat, actually burning the H_2S with a flame outside the apparatus. That this is what takes place in the "Collos" process cannot reasonably be doubted. Dr. Colloseus did, however, in his German master patent deny that water had any chemical action from palpable forensic reasons, and we got acids in a "state of nascence" as an explanation of an obvious and well-known fact. How that eminent body, the German Patent Office, swallowed this pill, goes beyond human comprehension. A cement of this type, entirely free from uncombined lime, is a thing which I should like to see, but I should hesitate before going up to an engine, the foundation of which was made with it.

John Rhodin, F.I.C.

Westminster, *February 14th*, 1910.

LEGAL.

Re E. RUSSELL & SONS.

AT the Manchester County Court on 9th inst., before his Honour Judge Parry, application was made for a compulsory winding-up order in the case of E. Russell & Sons, Ltd., electrical engineers and contractors, Cross Street, Manchester.

In making the application on behalf of the British Westinghouse Electrical and Manufacturing Co., Ltd., DR. ATKINSON said the company had a nominal capital of £5,000, but only 600 £1 shares had been allotted and paid for. The petitioners' debt was £1,368, the total value of trade debts amounted to £2,184, and the order for winding up was supported by creditors for £2,070. A resolution to voluntarily wind up the concern was passed by the shareholders through inability to pay the debts, but the creditors were not satisfied with that. A few years ago Mr. W. E. Russell, from whom the company purchased this business, had three businesses, in Oldham, St. Anne's and Cheadle Hulme. This company was formed to take over the Oldham business, and there were many things which necessitated inquiry.

MR. T. G. RUSSELL, solicitor for the company, said he had given the petitioners every chance of obtaining the facts, but a misunderstanding had arisen.

JUDGE PARRY pointed out that as the bulk of the creditors desired a compulsory winding-up order, the law said there must be one, and it was accordingly granted.

BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., *v.* BRAULIK.

IN the Second Court of Appeal on Saturday, the reserved judgment of the Master of the Rolls and Lords Justices Fletcher Moulton and Buckley was delivered on the appeal by the British Westinghouse Co. from a judgment of Mr. Justice Joyce, of October 18th, 1909, refusing to uphold their patent for an improvement in the control of downward pointed electrodes in arc lamps. (See ELECTRICAL REVIEW, October 22nd, 1909, p. 652.)

LORD JUSTICE MOULTON, in delivering the judgment of himself and the Master of the Rolls, said this was an action brought by the plaintiffs, who were the registered owners of Letters Patent No. 18,786 for "Improvements in Electric Arc Lamps." The defendants raised all the usual defences, but the substantial questions were those of want of subject matter, and anticipation by the specification of Graham, and the specification of Crosby and Shaw. Those defences raised points with regard to the meaning and extent of the claim in the specification which would require careful examination. There was no substance whatever in the objection as to insufficiency of specification, and he was clear that the defendant's lamp was an infringement. The differences between it and the lamps shown in the figures were only small differences of mechanical arrangement which did not touch the question whether the plaintiffs' invention was used in its construction. He was, therefore, of opinion that both those defences failed. To deal with the substantial defences of the action, it was necessary to examine in detail the specification itself. The invention described and claimed therein related to a class of electric arc lamp in which the carbons were inclined to one another, and were both of them fed downwards, so that the arc was approximately horisontal. The carbons passed through holes in the base-plate of the lamp upon which the mechanism rested, so that the lamps had the great practical advantage of casting no shadow downwards, and had accordingly come into very extensive use in late years. Concurrently great changes had been made in the manufacture of the carbon electrodes used in arc lamps. Formerly the aim was to make them of the very purest carbon, so that they would be consumed evenly and present no irregularities of constitution which would affect the steadiness of the arc. But it had been known for several years past that the presence of other elements in the arc (especially fluorine and chlorine) greatly increased its illuminating power. They permitted the arc to be considerably longer than when carbon alone was used. In spite of all the care with which electrodes were made, these composite electrodes presented greater irregularities than those of pure carbon, and this, combined with the extra length of the arc, rendered it at once more difficult and more important to have a mechanism in the lamp capable of instantaneously adjusting the electrodes so as to compensate for these irregularities and keep the light steady. The plaintiffs claimed that the mechanism shown and claimed in their specification had been the solution of this problem, inasmuch as their lamp promptly adjusted itself to the changes of resistance in the arc which accompanied these fluctuations, and that it was by the use of this invention that horizontal "flame" lamps had come into practical use in this country. He was of opinion that this contention of the plaintiffs was justified by the evidence. No flame lamp of this type was successful until after the date of the plaintiffs' patent, and practically all such lamps in this country were made according to that invention. Some 14,000 of such lamps made under licence had been sold in England, apart from any of the alleged infringements, and he had no doubt that the success of these lamps at the present time was substantially due to the fact that their construction followed this invention. Counsel for the respondents urged that these lamps, as actually sold and used, differed in detail from that which was shown in the Letters Patent. This was always to be expected in the case of the commercial article, for small practical improvements in manufacture were always made when an article commenced to be produced on the commercial scale. But he had no doubt that these commercial lamps were substantially made according to the Letters Patent, and although counsel for the defendants might be justified in alleging technically that they were not made in exact accordance with the figures or the letterpress description contained in the specification, he was satisfied that the differences were unimportant. Had it not been so, the experienced counsel for the defendants would have accepted the repeated offer by counsel for the plaintiffs to produce a specimen of the commercial lamp and submit it to the Court in order that the Court might judge for itself as to whether it was made according to the plaintiffs' invention. This repeated refusal, combined with the fact that the defence of non-utility was abandoned, left no doubt in his mind that practically a great advance was made by the plaintiffs' invention. The invention of the plaintiffs attained this success by selecting a type of lamp which avoided certain difficulties met with in other forms and applying thereto an improved mechanism which rendered it capable of instantaneous response to changes of resistance in the arc. One of the merits of the invention and, to judge by the failure of his predecessors in this line, one which had contributed greatly to his success was that he had realised that the use of friction as a means of control of the feeding of the carbons, or as giving the requisite electric contact to enable the current to enter the electrodes, must be avoided. His invention, therefore, dealt only with lamps in which the current was supplied to the electrodes by their upper ends being firmly clipped, and the electrodes were lowered simultaneously through the same distance. But this avoidance of friction would not alone give the requisite sensitiveness were the adjusting arrangement burdened with considerable inertia. This he avoided by pivoting one of the electrodes, which was otherwise free from the feeding mechanism, and operating upon it near its lower end, thus securing a minimum of mass to be moved and enabling the adjusting mechanism to be made very sensitive without interfering with rapidity of obedience. It would be seen therefore that the adjustment of the carbons relative to one another in the plaintiff's invention was accomplished in two ways. In the first place, there was the longitudinal feed downward in the direction of the length of the carbons, and in the second place, the end of one of the carbons was moved to and from the other horizontally by means of the swing of the electrode on its pivot. The first of these operated from time to time as the carbons became consumed, and it was regulated by its own mechanism, which might be any of the well-known feed mechanisms which operated when the arc failed or the resistance became great. But in the intervals of these "feeding" motions (properly so called) there must be continual adjustments of the distance between the carbons depending on the irregularities of the arc if the lamp was to work steadily as a "flame" lamp. These were wholly provided for by the swinging motion of the electrode, and it was in this that they found the element of novelty which, when introduced into lamps of the special type to which he had referred, had succeeded in solving the important practical problem of rendering flame lamps with a horisontal arc stable and useful. This distinction between the two adjustments was clearly set out in the specification. He was of opinion, reading the claim with the text of the specification, that this claim was restricted to the use of a particular form of horisontal feed mechanism and did not cover the use of any form of horisontal feed mechanism in the specified type of lamp. The claim, therefore, was for the use of such horisontal feed mechanism in connection with a downward feed mechanism by which both electrodes were lowered simultaneously through the same distance in a lamp where downwardly pointing electrodes inclined to each other were used, and the carbons were firmly clipped in the upper ends of those electrodes so that no friction was necessary in order to give access to the current. The question for the Court therefore was whether such a combination was good subject matter for Letters Patent and whether it was new at the date of the patent. The alleged anticipation by Crosby's specification might, in his opinion, be dismissed. It was clear that the carbons were not clipped firmly and the current led into the carbons in that way. This lamp did not therefore come within the claim of the plaintiffs' specification, and certainly it would not in any way lead up to his invention. The most serious and only remaining prior publication was that of Graham, and it was on this that the

defendant chiefly relied, alleging, in the first place, that it was an actual anticipation, and, in the second, that if not an actual anticipation it prevented the plaintiffs' invention possessing good subject matter for the grant of letters patent. It was clear that Graham had the idea of a pivoted electrode and of a downward feed equal and simultaneous in the two carbons. He used the play of the pivoted electrode for striking his arc, and the striking of the arc occurred when the current through the magnets was such that it indicated that the arc had broken, or had a resistance greater than a certain standard. But there was nothing in the letter-press, or in the drawings, which indicated that the inventor intended any adjustments to take place in the intervals of feeding by reason of the varying resistance of the arc, and he was satisfied that he had no idea of producing such adjustment. Nor did he think that anyone making his lamp according to the specification and drawing would produce a lamp which would have such adjustments, or, to use the technical phrase, would have a "floating feed." The defendants produced a lamp which they alleged was made by them in accordance with this specification and drawing, and put it before the witnesses of the plaintiffs in cross-examination, and suggested that this lamp would work and would possess a floating feed. When the defendant's case came on no evidence was produced as to the performance of this lamp, and he thought they must take it, therefore, as against the defendants that they were unable to prove their suggestions with regard to it. This confirmed the conclusion to which he would have come on the specification and drawing itself—namely, that they did not publish to the world the invention of the plaintiffs, and could not be regarded as an anticipation of it. With regard to the argument that there was no good subject-matter in the plaintiffs' invention, because in lamps with vertical feed in which the carbons approached one another along the line of the carbons themselves the floating feed had long been well known, in none of the cases in which floating feeds were used, or proposed, was there any adjustment otherwise than in the line of the carbons, and the natural application of that to sloping carbons with downward feed would be to draw up or down the carbon along the line of the electrode, an arrangement which would be different, and immeasurably inferior, to the invention of the plaintiff, and would not be included within his grant. The result of following the devices for obtaining a floating feed which were in use at the date of the patent (if they were at all applicable to the type of lamp in question) would be to produce an arrangement which would possess neither the sensitiveness nor the practicability of the plaintiffs' invention, because the adjusting mechanism would have to deal with parts possessed of much inertia instead of the light pivoted electrodes of the plaintiffs. He was, therefore, of opinion that there was good subject matter in giving to a lamp of this type a floating feed in the manner in which the plaintiff proposed to do it. No one reading Graham's specification would be led to give to it a floating feed, nor, if he set about doing it, was there any reason to believe that he would have done it in the way described and claimed in the plaintiffs' specification. He was of opinion that the argument of the defendants was unsound, and that the Letters Patent were valid. The judgment of the learned Judge in the Court below proceeded on a wider interpretation of the claim than, in his opinion, it fairly bore. He did not think that the patent was for every mode of effecting the object in question in any arc lamp having the specified characteristics. As he thought that the horizontal feed mechanism was of a certain definite type, the objection to the validity of the patent, which was the sole ground upon which the Judge of first instance decided in favour of the defendants, did not, in his opinion, apply. He was of opinion, therefore, that the plaintiff had established his case and was entitled to the relief he claimed.

The Master of the Rolls concurred in this judgment.

Lord Justice Buckley said that he was of opinion that the plaintiffs were entitled to judgment. There was good subject matter for a patent, and the appeal ought to succeed.

Mr. Walter, K.C., for the appellants, asked for an injunction, an inquiry as to damages, delivering-up of the infringing articles, and costs of both the hearing below, and the appeal.

Mr. Gray, for the respondents, asked for a stay of execution, with a view to an appeal to the House of Lords.

Their Lordships directed that judgment should be entered for the appellants as asked, but stayed the order so far as it related to the inquiry for damages for one month.

The Electrical Co. v. Thomas, Son & Co.

Mr. Pollock, the official referee, continued the hearing of the above case in the High Courts on Thursday last week. It will be remembered (see Electrical Review, December 31st, 1909, p. 1056) that the Electrical Co., of London, were suing Messrs. Thomas, Son and Co., colliery proprietors, of Neath, Wales, for payment of balance of an account they alleged to be due in respect of an electrical pumping plant supplied to defendants to unwater their mine in the Lynvi Valley. Defendants declared that the machinery supplied was not satisfactory, and was inefficient. It failed to unwater the mine, and in consequence they had suffered considerable damage. They counterclaimed some £30,000 in respect of this damage.

Plaintiffs' former manager, Mr. Stottner, went into the witness box again, and was further examined at considerable length on the correspondence, and the hearing was adjourned.

On Friday Mr. Stottner was further examined. With the conclusion of his evidence plaintiffs' case finished.

Mr. Williams, K.C., proceeded to open the defence and counterclaim. It was clear, he said, that plaintiffs' claim had gone. Plaintiffs entered into a contract with defendants to provide plant and machinery to unwater the mine in 6 to 10 weeks; they did not, as a matter of fact, unwater it in two years. If the mine had been unwatered in the contract time defendants could have worked the coal when it was at a price which would have returned them a very handsome profit. If it turned out that the defendants lost these profits owing to the default of the plaintiffs in not carrying out their contract, then the matter came down to a question of how much defendants were entitled to as damages. There was a suggestion that Messrs. Thomas ceased working the mine because they found that they would not be able to realise their profits as the mine was not productive, and that it would be more profitable to force their counterclaim against plaintiffs. He would prove that there was abundance of most valuable coal in the mine and that there was no truth in any such suggestion. The whole question was what was the amount of damages to which defendants were entitled.

Mr. W. H. Thomas, junior partner in the defendant firm, gave evidence as to the daily running of the plant with a view of showing that it was not satisfactory. When the engine was laid down there was a knock in the bearing of the crankshaft, and although plaintiffs' men tried to remedy the defect, for months they were unable to do so. On May 2nd Messrs. Day & Blake, electrical engineers, came down and tried to get the exciter to work, but they were unable to do so. On the following day they got the exciter to work, and although the knock in the engine bearing was bad, the pump was started on May 9th. It worked very badly, however, and only threw 100 gallons of water per minute with a 50-ft. head of water, instead of 250 gallons per minute. By the 11th the pump was throwing fairly well, but the engine bearing had to be kept cool by pouring oil over it. By the 15th the bearing was so hot that the pump was stopped altogether. The following day it was discovered that the cylinder covers had been put on the wrong way round, with the result that the pump was being throttled. By July the pump was working so badly that they decided to try the old steam pumps, which had been practically under water ever since the mine was flooded. Luckily, they worked, and so the situation was saved. On July 6th the exciter took half an hour to start. On November 4th his firm received an account from plaintiffs for the sum of £1,035, and on the 15th he wrote declining to remit any payment on account of the plant, declaring that plaintiffs had simply been experimenting in the colliery up to that time. He also said the water in the drift had been kept down by steam pump at considerable expense to defendants, which plaintiffs would have to compensate them for. Plaintiffs replied that they were consulting their solicitors, and afterwards the latter wrote stating that £1,150 was due to plaintiffs under the contract. Witness denied the allegation of plaintiffs that the carbon brushes were not properly faced on to the exciter by defendants' men, thus causing the exciter to work improperly. The brushes were taken out of the brush-holders and properly sandpapered down to keep a right surface on the commutator. When the exciter failed in this way, it would sometimes take from two to five hours before they could get it to excite again. During May, 1907, day after day the exciter failed to work, and on May 29th defendants wrote to plaintiffs repudiating the suggestion that these failures were due to negligence on the part of Messrs. Thomas's men. In their opinion the trouble was due to the defects in the field windings. On June 1st the engine was stopped, and another exciter was installed whilst the faulty machine was overhauled. It was reinstalled, but shortly afterwards the machine again failed, and the pump itself was working very badly. As a result the water rising very fast got the control, and they had to save the machinery as best they could. Next day the mine was flooded and the machinery all idle. Next day Mr. Stottner came and endeavoured to demonstrate that there was nothing the matter with the exciter. Steam was got up and the machine started. It varied some 50 volts running on light load and some 200 volts on the alternator. Mr. Stottner made light of the flooding, and said it was a small matter; they would get the water out in a few days. Witness said he would have nothing more to do with the matter unless plaintiffs put in a new exciter. Afterwards, said Witness, the second agreement was entered into under which plaintiffs were going to undertake the task of unwatering the mine. Further examined, Witness said that in October there was a dispute with the miners. The men left without notice, and were eventually sued. They were demanding a minimum wage of 5s. 4d. a day, plus percentage irrespective of the work done, instead of 2s. per ton, plus percentage. It would have been quite impossible to accede to the miners' request, and they got the machinery up, while they had the men to do it—otherwise they would have lost everything. Witness denied that they ceased working because the mine was unproductive, and that they had struck a "fault." The working of the coal was very spasmodic in consequence of the breakdown of the electric pumps, and the coal that was obtained could not be worked at anything like a profit.

(To be continued.)

The "Z" Electric Lamp Manufacturing Co., Ltd., v. Marples, Leach & Co., Ltd.

In the Chancery Division on the 10th inst., Mr. Justice Parker had before him this patent action brought in respect of an alleged infringement of Patent No. 21,654 of 1906.

Mr. Walter, K.C., and Mr. Colefax appeared for the plaintiffs; and Mr. T. Terrel, K.C., and Mr. McConkey for the defendants.

Mr. Walter said that the patent in question was granted to one, Johnson, and was for an invention relating to improvements in the manufacture of filaments for incandescent electric lamps. Tungsten was largely used as a very fine powder mixed with hydro-carbon. It was capable of being made into a pencil when

mixed with some binding material, such as nitro-cellulose and castor oil. It was then under pressure passed through a die as fine as ·025 mm. The resulting thread was heated in an oven, in the course of which process a large portion of the hydro-carbon was evaporated. The result was a carbonised thread in the shape of a hairpin, but no longer flexible. This was put into the glass bulb, the air exhausted and electric current passed through the thread. This burnt out the carbon, the metal fused and they got a thread of tungsten. That was the state of things in 1906, but there was always a liability when the lamp was exhausted of "blackening." The invention in question was to prevent that blackening. The invention consisted of adding to the filament either in the making, or when made, or painting on to some part of the inside of the lamp a substance called phospham, a compound of phosphorus and nitrogen and hydrogen. The result of the use of it was that it removed the carbon. The phospham was generally deposited on a glass rod which supported the filament, but how it was used was not material so long as it was inside the glass bulb. That was the invention as described in the specification. Counsel proceeded to describe a number of ways by which the process of introducing the phospham might be carried out. The defendants called their lamp the Adnil; they said that it represented the latest development of the metallic filament. The filament was composed of tungsten. They said that the plaintiffs' invention was not useful, that the invention was not sufficiently described in the complete specification, and that phospham phosphoraminic acids, phosphoramidoamide and phosphorus sulphotriamide did not act on the carbon in the filaments in the way described in the specification. It was further objected that phospham was not capable of removing carbon from a tungsten filament in any of the ways described in the specification. Counsel handed in a document to show that phospham could be bought in 1906.

Mr. Terrell said it was not published in England. He wanted something in English.

Mr. Walter said practically every chemist bought from the firm of Schuchardts. He said that his learned friend's case was that this was a patent for the manufacture of pure tungsten. It was a patent for the removal of impurities in the manufacture of incandescent lamps. If any of the processes described were used, the result would be that there would be no blackening.

Mr. James Swinburne, examined by Mr. Colefax, said that he had read the specification, the particulars of objection, and had made a number of experiments in connection with the case. The alleged anticipations did not seem to come anywhere near the point. He did not know what they were for. The plaintiffs' invention was certainly useful. It is said that phospham at the date of the patent was an unknown substance. Witness said that the name was quite familiar to him when it came up in connection with the present case, and he found full information about it in his library. There was plenty of scientific information about the nature of the body. He believed it was procurable at the date of the patent; he had tried most of the ways described for carrying out the invention, and he found it obtained the objects of the inventor. In 1906 it was a common experience to have blackening in tungsten filament lamps. The blackening was attributed to carbon. He had no doubt that the patentee attributed the blackening to carbon, and he appeared to be right, but how that was so Witness did not know. He had examined the black deposit, and found that it was tungsten.

Cross-examined by Mr. Terrell, Witness said that he did not expect in chemistry a complete reaction. There was always something a little imperfect. He should think that the strength of the filament would be affected by the presence of carbon, but he had not tested it. He knew that the lamps sold to and by the defendants in this case were made by the Bergmann Co., but he did not know that they were defendants in another action that had been brought against them. He did not know that the lamps made by the Bergmann Co. before the use of any phospham at all, after the process of centring or flashing, only contained between ·014 and ·015 of 1 per cent. of carbon. He did not know that, if that was so, the removal of the carbon would be immaterial. By phospham they could sometimes remove so much of the carbon that they could not find any at all. He should not think ·014 of 1 per cent. of carbon would hurt a lamp. It might improve the lamp to remove it, but he should have thought it would be good enough. He had not tested many blackened lamps, because he thought that if one showed tungsten the others would. It did not look like the colour of carbon blackening. He did not notice any difference in the smell of the blackened and the unblackened lamps. He did not by smell detect cyanogen in the unblackened lamps. They had a phosphorus smell. A great number of specimens were put to witness, and he was cross-examined at great length on the chemical formulæ of phospham and other substances.

Electric Lamp Thefts.

At the Swansea Police Court on Monday, the Bench disposed of a number of cases that had excited the greatest interest in the town. Two had been held over from the previous week. The defendants the previous week were:—David Thos. Mathetas Jones (23), charged with (1) stealing and receiving four electric lamps (value 15s.) on January 7th, 1910; (2) stealing and receiving four electric lamps (value 15s.) between October 22nd and October 30th, 1909; and stealing and receiving one electric lamp (value 3s. 9d.) between October 22nd and October 30th, 1909. Charges of a somewhat similar nature were made against William Goslin, 32; Thos. Prosser, 33; Ed. John Barrett, 26.

Mr. Laurence Richards, in opening the case, said the electric light department had discovered that many lamps had been missing during the last 18 months. Many had been stolen from the standards in the streets and many from the store-rooms. During 18 months they had missed 150 lamps from the stores.

The electrical engineer, Mr. Carl Prusmann, said that Jones was an employé at the station, and assisted in looking after the stores. He could identify the lamps produced (Osram) as being similar to those received into stores.

Mr. Richards: Have you any doubt as to the lamps?—I have no doubt as to two lamps numbered 2,458, because lamps of that number were supplied to Swansea Corporation only.

John Grove, 149, Port Tennant Road, St. Thomas, butcher, spoke to defendant coming to his shop, and, after some conversation, replacing two lamps, one broken and the other dirty, for which he paid him 6s. He bought two others at the same price.

A statement was put in by defendant as follows: Only two I sold him. I took two back to the works and threw them on the scrap heap. They had broken filaments. I had four from the works, and I hope you will look over it this time. I saw the other fellows making a few shillings, and I thought I would make a few myself.

Defendant pleaded guilty, and the case was completed on Monday this week.

The Bench said that it had been a most unfortunate prosecution, and the result had been most unsatisfactory, both on the part of the police, the prosecuting solicitor, and the Corporation. The state of things existing had a most unfortunate effect upon the man Jones. He could not see why the Corporation should not have had the lamps marked like the County Council. The Corporation should look into the matter, not so much in the interests of the ratepayers, as in the interests of their employés. He thought there should be a proper system of booking, checking, &c. He (Mr. Fred Rodge) and Mr. Hall had decided to deal with the man under the First Offenders' Act. He was bound over, under the Probation of Offenders Act, for 12 months.

In the case of Goslin, the engineer would not swear that the lamps produced were the property of the Corporation.

This case was dismissed, the defendants' solicitor maintaining that there was no charge to meet. In the second case against Goslin the prosecuting solicitor said he was in the same predicament of not being able to positively identify the lamps. He withdrew the charge.

The charge against Thomas Prosser—which was adjourned in order to call further evidence as to identification of the lamps—was withdrawn on Monday.

The one charge against Barrett was dismissed.

Tramway By-law and Miners.

At a Justice of Peace Court, Glasgow, on Monday (February 14th), six miners were summoned for a breach of the T.C. Tramways by-laws, by having travelled in a car in clothing which, in the opinion of the conductor, might soil or injure the car or dress of the passengers, and also with having failed to leave the car when requested. The defence was that the accused had been detained at the pit bottom until the last workmen's car had gone, and then had boarded an ordinary car. As the prosecution was the first of the kind under the by-law, the men were admonished and dismissed.

Train Lighting in Germany.—A retrogressive movement in regard to the lighting of trains is proposed by the Prussian Minister for Railways. A few years ago the defects of gas lighting induced the railway authorities, in emulation of the action taken by other State railways, to make experiments with various systems of electric lighting, particularly in the direction of installing reading lamps over the carriage seats, as an addition to the gas lamps suspended from the ceilings of the carriages. As the results met with approval, the authorities decided to install electric reading lamps in all the D coaches, numbering about 800, the lamps being supplied from plant carried in the luggage vans, with batteries for maintenance of the light when the trains were at a standstill or travelling slowly. This arrangement caused difficulties to arise when the coaches of other German and of foreign railways, which were not similarly equipped, were coupled to the Prussian trains, in which the lamps were often without current owing to the lack of connections. Since that time gas lighting on the incandescent system has made progress, and in view of the increased effects thereby obtained, the Prussian Minister for Railways has now issued an order for the removal of electric reading lamps everywhere, and for the lamps to be used in future for the illumination of sleeping coaches. The only exceptions are the completely electrically lighted trains travelling long distances, as between Hamburg and Berlin, Hamburg and Cologne, &c. No explanation for the discontinuance of the lamps has been given, and it is said that their removal implies a loss of £25,000 represented by the value of the lamps and fittings. The decision of the Government must be deplored, in view of the dangers inherent in gas lighting. Only a few weeks ago we recorded a disastrous accident on a German railway resulting in the burning or suffocation of many passengers through the ignition of escaping gas

BUSINESS NOTES.

Stoker Contracts.—Among orders for stokers recently filled by THE UNDERFEED STOKER CO., LTD., are the following:—

Musselburgh Tramways	2 E.
Borough of Tunbridge Wells	2 B. 5
Yorkshire Power Co. (repeat)	2 E
Dublin United Tramways	1 E
Fremlin Bros. (repeat)	2 B. 5
Rossall School	2 B. 3
Geo. Wilson & Sons, Glasgow	2 B. 5
Borough of Torquay	5 B. 5
Mount Lyell Mines, Australia	1 B. 5
Cairo Tramways (repeat)	1 E.
Odessa Tramways	12 E

Bankruptcy Proceedings.—SAMUEL EMERSON SMITH, electrical engineer, 271, High Street, Lincoln.—This debtor attended at the Session House, Lincoln, last week, for his adjourned public examination, before Mr. Registrar Stephen. The examination had been previously adjourned in order that the debtor might furnish an amended cash account. In reply to questions, debtor said he was now employed by his wife as manager for Smith's Electrical Co. The Official Receiver asked for a further adjournment, and said he would forward all papers to London, and this request was complied with.

A. E. FELGATE and W. STOREY, electrical engineers, Reading.—First meeting February 23rd, at 14, Bedford Road, W.C.; public examination, March 10th, at Reading.

HARRY GRAHAM, electrician, &c., Albion Street, Huddersfield.—This debtor's adjourned public examination took place last week, and the Registrar declared the case closed.

Dissolutions and Liquidations.—The partnership between Mr. Dewhurst and Mr. G. R. Peers, trading as PEERS AND DEWHURST, 59, Bridge Street, Manchester, has been dissolved, and for the present Mr. Dewhurst is continuing the business as contractor at the same address. The partnership terminated on December 7th last.

Mr. Peers is now again practising as a consulting electrical engineer at 33, Manchester Chambers, Market Street, Manchester, and, in addition, acting as intermediary between clients disposing of or requiring electrical or mechanical businesses, arranging partnerships, and generally as a technical adviser or agent between employers and employés, his 10 years' experience as a consulting electrical engineer in Manchester forming an excellent qualification for these functions.

OKONITE, LTD.—A meeting is to be held on March 14th at 56, Moorgate Street, E.C., to hear an account of the winding-up from the liquidator, Mr. W. T. Ogden.

SIMMS MAGNETO CO., LTD.—A meeting is to be held at 14, Regent Street, S.W., on March 11th, to hear an account of the winding-up from the liquidator, Mr. H. M. Scott.

Consular Notes.—Turkey in Asia.—The Belgian Consul for Turkey in Asia reports that the importation of electrical apparatus and machinery into Turkey in Asia having been authorised for only a year, the trade in these goods is, of necessity, only small as yet. Moreover, the absence of Customs statistics makes it impossible to state exactly the amount of importation. The apparatus and accessories which should particularly attract the attention of the merchants and manufacturers of the country are the following: Continuous-current dynamos of from 2 to 15 KW., switchboards, arc lamps, incandescent carbon lamps, incandescent metal-filament lamps, flexible cables for arc lamps, incandescent lamps and bells, simple insulated wire, white and black india-rubbered tapes, insulators, interrupters, batteries for bells, contacts, private telephone installations, ventilators of all kinds. The majority of these goods are imported from German, Austrian and Hungarian works, and a small part come from English, French and Italian works. All houses have agents on the spot who keep up a keen competition. It is difficult to quote prices; the agents seem to be given every latitude to reduce them to a minimum if necessary, so much so that the prices have reached the limit of cheapness. Electrical apparatus imported into Turkey pays the general duty of 11 per cent. *ad valorem*. [This duty will probably be raised to 14 per cent. in the near future.—EDS. E.R.] The only electrical installations existing at Smyrna and in the district are the following, which are for private lighting purposes: Hotel et Cinematographe, J. Kraemer, successeur; Restaurant et Cinematographe du Café de Paris; Brasserie Klonaridis; cotton-spinning mill of the Cie. Industrielle du Levant; ice works of the American Ice Plant; tanning extract works of C. Whittall & Co.; property of M. T. Bowen Rees, of Boudja, &c. Dr. Jovanovich and the Greek Hospital have electro-therapeutic installations. There are two proposals for the installation of works. The first, which will probably be put into effect soon, is the concession granted to M. Solon S. Choraffa, of Smyrna, for the electric lighting of Boudja, a summer resort with about 20,000 inhabitants, near Smyrna. The second is that for electric light and traction purposes, and the supply of electric power to Smyrna and district, by a Belgian company recently formed under the title Société Generale de Tramways de Transports et d'Electricité à Smyrna, with headquarters at Brussels. The following firms, representing the firms whose names are given with theirs, are the only ones dealing with the importation of machinery and electrical apparatus in Smyrna. All, with the exception of the Austro-Orientalische Handelsgesellschaft, and Messrs. Warren, Beattie and Co., are bound by exclusive contracts to the works they represent:—Balladur, Rankin & Demas (Allgemeine Electricitäts Gesellschaft, Berlin); Solon S. Choraffa (Cie. Generale d'Electricité, Paris); Paul Milberg (Siemens-Schuckert Werke); Pennetti fils; Fabius Henrion; Austro-Orientalische Handelsgesellschaft (Perres, Blau and Lucacs; Gengely-Nolnar, Buda-Pesth, Internationale Electricitäts Gesellschaft, Vienna); Warren, Beattie & Co., Ltd., electric power engineers (various English firms). In order to introduce their goods to the Smyrna market, manufacturers should first of all choose a good agent. As one may readily suppose, in view of the recent withdrawal of the prohibition of importation of electrical goods, specialists in the electrical industry are extremely rare. Competing houses have consequently been obliged to recruit their representatives from various branches of trade. They have given them a certain number of apparatus of current types, and have left them considerable latitude in trading, particularly in the matter of credits, they have supplied them with illustrated catalogues and plans, have advertised, and still continue to advertise, extensively in the local papers, and have, moreover, offered to investigate free of charge questions of new enterprises. This is in general the course to take, at first taking care to establish the fact that the agent is reliable and honest, and then to inquire into the standing of proposed customers. Too great care cannot be taken to avoid legal cases, which are long and costly. Again, it would be foolish to imagine that the Smyrna market would put up with inferior qualities of goods or with depreciated models. The necessities of foreign competition force the manufacturers of all countries to send to the country articles of the very best class with all the modern improvements. Sales are at present small, as is only natural, but it would be well for manufacturers to establish themselves on the market in view of the expansion of trade, which will assuredly take place when concessions, which have already been granted, begin to work and when other new projects come to the front.

Engineering Employment Bureau and Electricians' Union.—The following interesting communication has been received, and deals with a matter of considerable importance. Proposals have often been made to establish a bureau of this kind, but have generally come to nothing;—

"Some time ago we were asked by a prominent engineering firm to obtain for them an engineer-in-charge and a switchboard hand. We duly advertised in your columns, and in reply we received hundreds of applications from all sorts and conditions, qualified and unqualified, some well fitted for the positions, and others too well fitted, and so on.

"As a result of this, it was suggested that an Association should be formed on thoroughly sound lines to classify and cope with the question of employment in the engineering industry. The above Bureau was therefore established, and we feel assured that it will be of great assistance to both employer and employé. The particular points that we should like to emphasise are:—

"Every man's training and experience is carefully and fully investigated, and his references are checked. Each man is classified by a card-index system under various headings, according to his experience and abilities, and this index is carefully graded and arranged, so that we can put our hands on the right man at short notice.

"No candidate's name is submitted to an employer until full particulars of the vacancy have been sent to him, and he has signified his assent to be nominated. Free advice, either legal or technical, is given to any subscriber who may desire it.

"The services of fully qualified engineers in the various branches of the industry have been retained, and their advice is carefully considered and followed when selecting candidates for vacancies in these special branches.

"From the employers' point of view, we maintain that it will be assisting them considerably in the matter of securing reliable men of guaranteed ability. It will be seen that a considerable amount of trouble and expense will be saved, and those to whom the scheme has been submitted have expressed unqualified approval of the same.

"In addition to several vacancies already on hand, we have many inquiries from employers, and anticipate that we shall be the means of placing a large number of efficient men. The subscription of 10s. 6d. is a reasonable one, and entitles the subscriber to our services for one year from date of enrolment. In addition to the foregoing charge, we claim a small percentage on the first three months' salary.

"THE ENGINEERING EMPLOYMENT BUREAU AND
"ELECTRICIANS' UNION.
"J. Eaton Bird, *Secretary*.
"Rogers Chambers, Norfolk Street,
"Sheffield, *February 1st*, 1910."

The conditions appear to us to be reasonable, and we wish the undertaking a successful development.

Water Purifying Plants.—During last week MESSRS. JOSEPH WRIGHT & CO., of Tipton, Staffs, and London, booked the following orders for their patent water purifying plants:—

Messrs. Loders & Nucoline, of Hammersmith, London. One patent cold process water softening and purifying plant.
Messrs. Craddock, Allison & Co., Eaglescliff, Co. Durham. One patent combined heating, softening and purifying plant.
Patent combined heating, softening and purifying plant.
Melbourne Corporation Electricity Department. One patent greasy water purifying and hard make-up feed softening plant.

Among orders at present in hand, or just executed, are:—

Copper Miners' Tinplate Co., Ltd., Cwmavon Tin Works, Glam. Patent combined heating, softening and purifying plant.
The Glenavon Garw Collieries, Blaengarw. One ditto.
Terry Greaves & Co., Wakefield. Ditto.
The Edinburgh Collieries. Two plants, which are a repeat order.
The Baddesley Collieries Trustees, Atherstone.
Ansell's Brewery, Birmingham.

Book Notices. — The *Queen's Engineering Works Magazine* for January attains to a very high order of merit, containing a variety of interesting articles, which deal not only with local matters of special interest to the pupils and staff of Messrs. W. H. Allen & Son, but also with general engineering topics. In the editorial notes the revival in trade during 1909 is discussed, and the prospects are regarded as considerably brighter than a year ago. The annual distribution of prizes to pupils and apprentices forms a prominent feature, the prizes being presented by Mr. J. A. F. Aspinall, president of the Institution of Mechanical Engineers, who also delivered an interesting address upon the advance of engineering knowledge. The "Allen" prizes were awarded to Mr. C. B. Clark (pupil) and Mr. R. Willett (apprentice). The chairman of the company in his review of the year describes the extensions of the works carried out in 1909, and some important contracts, including a large quantity of electrical dock-pumping machinery, &c., for the Japanese Imperial Arsenal at Sasebo, eight steam dynamos for the *Olympic* and *Titanic* (which will be bigger than the great Cunarders), and other large orders. We are pleased to note that Messrs. Allen are doing so well in their foreign and Colonial export trade, as well as at home. Their admirable and efficient system of tuition of pupils, in the hands of special instructors, is, of course, widely known.

Hazell's Annual Guide to the New House of Commons.—London: Hazell, Watson & Viney, Ltd. 6d. net.—The publishers of *Hazell's Annual* have lost no time in fulfilling the promise made in their *Annual* of early publication of the guide to the new Parliament early after the close of the Election. This pamphlet (78 pages) forms a fitting supplement to the *Annual*, and it contains notes on the cause of the General Election, its results, the relative positions of different parties, brief biographies, with addresses of M.P.'s, &c.

Fowler's Mechanical Engineer's Pocket Book, 1910. Twelfth edition. *Fowler's Electrical Engineer's Pocket-Book*, 1910. Tenth edition. Edited by W. H. Fowler. Manchester: Scientific Publishing Co. Price each, 1s. 6d. and 2s. 6d. net.—The wealth of engineering information at the disposal of the mechanical or electrical craftsman nowadays, at a nominal price, is well exemplified by these two volumes, which take a high place in the list of annual pocket-books, and are packed with practical knowledge in small compass. They have the advantage of opening like other books, not end-ways, and are convenient for the pocket, having rounded corners—though we doubt whether such "pocket books" are often so carried. The higher-priced copies have gilt edges, a feature which is pretty, no doubt, but from a purely practical point of view a drawback, as the pages stick together until the gilt is worn off; but the better binding may compensate for this. As for the contents, which, after all, are the only things that matter, we cannot, and fortunately need not, review these in detail; those who have bought the books in past years will do so again, and those who have not should begin now.

Spons' Architects' and Builders' Pocket Price Book. Thirty-seventh edition. Edited by Clyde Young; revised by S. M. Brooks. London: E. and F. N. Spon. Price 3s. net.—The present edition has been enlarged to 628 pages, and the Price Book Section has been amplified and revised. Tables of Constants of Labour for all trades have also been included. There is quite a lengthy section on electric lighting, including a specification for a complete installation, with oil engine, battery, &c., and wiring rules in brief; and in the Price Book several pages of prices for electrical work are given. The book is one of the neatest and handiest that we know, being nicely printed on thin paper and really suitable for the pocket, while the wide range of information contained in it should render it very useful to electrical contractors.

"New Zealand. Papers and Reports Relating to Minerals and Mining." Wellington: J. Mackay. 1909.

"Post Office Electrical Engineers' Journal." Vol. II, Part 4. London: H. Alabaster, Gatehouse & Co. 1910. Price 1s.

"The Design of Condensing Plant." By F. W. Wright. London: Technical Publishing Co., Ltd. 1910. Price 3s. 6d. net.

"The Internal Lubrication of Steam Engines." By T. C. Thomsen. London: Technical Publishing Co., Ltd. 1910. Price 2s. 6d. net.

"Atti della Associazione Elettrotecnica Italiana." Vol. XIII, Part 6. November-December, 1909. Milan: Rebeschini di Turati.

"Annual Report of the Chief of the Bureau of Steam Engineering to the Secretary of the Navy, 1909." Washington, U.S.A.: Government Printing Office, 1909.

"Fortschritte in dem Bau von Bogenlampen (Timar-Dreger-Lampe.") By Prof. W. Wedding. Extract from the *Elektrotechnische Zeitschrift.*

"Pansies." By James B. Riding. London: Agricultural and Horticultural Association. 1d.

"*Proceedings* of the American Society of Civil Engineers," Vol. XXXVI, No. 1. January, 1910. New York: The Society.

"Bulletin of the Imperial Institute." Vol. VII, No. 4. London: Eyre & Spottiswoode, Ltd. Price 1s.

"Magnets and Magnetism." By A. W. Marshall. Model Engineer series. No. 34. London: P. Marshall & Co. 1910. Price 6d. net.

"The Indicator Handbook." By C. N. Pickworth. Part II. Manchester: Emmott & Co. London: Whittaker & Co. Price 3s. net. In this, the fourth edition, a note on diagram-measuring devices has been introduced, as well as a table of piston constants to facilitate horse-power calculations. Otherwise, this well-known handbook preserves its familiar appearance, and it needs no recommendation.

"The Engineer's Year-Book of Formulæ, Rules, Tables, Data and Memoranda for 1910." 17th edition. By H. R. Kempe, M.Inst.C.E. London: Crosby Lockwood & Son. Price 8s.

"*Journal* of the American Society of Mechanical Engineers." Vol. 32, No. 2. New York: The Society. 1910.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXIX, No. 2. New York: The Institute, 33 W. 39th Street.

"Science Abstracts." Sections A and B. Vol. XIII, Part 1, No. 145. Also Index to Sections A and B, Vol. XII. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each section.

"Traité de Physique." By O. D. Chwolson. Translated by E. Davaux. Vol IV, Part 1. Paris: Librairie Scientifique, A. Hermann et Fils. Price 12 fr.

MESSRS. EVERETT, EDGCUMBE & CO., LTD, 117, Victoria Street, S.W., have just issued a pamphlet dealing with technical considerations in connection with A.C. power measurements, giving the correct methods of connecting up wattmeters, power-factor indicators and idle-current indicators, which are applicable not only to their own instruments but also to most other types. The information, which is obviously useful and indeed necessary to those designing and erecting A.C. switchboards, has hitherto been more or less scattered and incoherent; by bringing it together into a compact and simple form, with a minimum use of mathematical expressions, Messrs. Everett & Edgcumbe have rendered a real service to the industry.

Private Meetings.—LONDON ELECTROBUS CO., LTD., Whitehall House, Charing Cross, W.C.—In pursuance of Sec. 185 of the Companies' (Consolidation) Act, 1908, a meeting of the creditors of the above was held on February 7th, at 15, George Street, Mansion House, E.C. The meeting was called by the liquidator (Mr. Thomas J. Garlick). The chairman stated that an extraordinary meeting of the shareholders was recently held, when a resolution for the voluntary liquidation of the company was passed. A further resolution was passed appointing Mr. Garlick as the voluntary liquidator of the company. No proper statement of affairs was presented to the meeting, but it was reported that the liabilities to trade creditors were in the neighbourhood of £1,350. With regard to the assets, these had been sold to a reorganisation syndicate for a sum of £3,000, payable as to £1,000 in cash, and the balance of £2,000 in shares. The issued debentures of the company were £9,000, and it would be seen that the assets were not sufficient to pay the debenture-holders in full. Under those circumstances, there was no prospect of the creditors receiving any dividend. A short discussion took place, but no resolution was passed, and the liquidation of the company was left in the hands of the present liquidator.

Tramway Meters. — MESSRS. CHAMBERLAIN AND HOOKHAM, LTD., Birmingham, write with regard to the action between the Gravesend and Northfleet Electric Tramways, Ltd., and the Gravesend Corporation, in which it was alleged that the meters used for measuring the energy supplied to the tramway system were some 20 per cent. wrong, to state that the meters were not of their make; by some error, they state, the name of their Mr. S. H. Holden was mentioned in connection with the case, but neither they nor anyone in their employ were concerned in the matter.

Catalogues and Lists.—HERR JOS. WOLFF, Frankfurt-a-M.—Leaflet illustrating and pricing their patent safety fuse for overhead lines.

MR. G. BRAULIK, 8, Lambeth Hill, E.C.—Price leaflet of "Eclipse" flame arc lamp carbons—yellow flame, with metal core.

EMPIRE ROLLER BEARINGS CO., LTD., 15, Victoria Street, S.W. —New leaflet describing and giving prices of their standard series of Empire patent roller bearings for trucks, wagons, inspection cars, &c. This is supplementary to their recently issued catalogue of line shafting bearings.

MESSRS. H. B. SILBERBERG & CO., 443, Bourke Street, Melbourne, Vic.—A handy-sized wall map of Australia has been received from this firm, who are importers there of scientific apparatus, chemicals, &c.

THE EDISON AND SWAN UNITED ELECTRIC LIGHT CO., LTD., 36 and 37, Queen Street, Cheapside, E.C.—Several new leaflets giving illustrations, prices, &c., of small power motors for A.C. and D.C.; multipolar D.C. motors (open protected, enclosed ventilated, and totally enclosed from ¼ to 20 B.H.P.); portable hand lamps complying with Home Office Regulations; electric table standards, and fancy glass shades.

MESSRS. ESTLER BROS., South Molton Road, Victoria Docks, E.—Post-card showing their patent steel shelving for stores, offices, &c.

THE SOLENOID REGULATOR CO., Geoffrey Buildings, John Bright Street, Birmingham.—Field rheostat list, giving in tabular form particulars of the resistances, carrying capacities and prices of their standard rheostats, which are wound with non-corrosive wire on porcelain tubes. The ingenious system of tabulation enables a remarkably wide range of particulars to be condensed into a moderate space.

THE A.E.G. ELECTRIC CO., LTD., 121-125, Charing Cross Road, London, W.C.—Abridged price-list for February. Although "abridged" this list contains 150 pages, and gives particulars and prices, with many illustrations, of D.C. and A.C. motors, drills, fans, cables and wires, insulators, conduit, and accessories of all kinds for installations of electric lighting and power, including switchgear, instruments, meters, cooking and heating apparatus, arc and

glow lamps, shades, &c. Besides a subject index, there is an index to price-list numbers, a glossary of technical terms, with some useful data, and a section giving illustrations only of the A.E.G. turbo-dynamos, transformers, winding engines, agricultural machinery, &c. The whole is a very handy and useful production.

The Davis Electrical Co., Ltd., 17, Moor Street, Charing Cross Road, W.—A 13-page list, giving particulars, together with illustrations and prices of several patterns of cast-iron water-tight lamp fittings for collieries, works, street lighting, &c., also dealing with arc lamp winches, bulkhead fittings, lamp guards, and the Britannia hand lamp.

Messrs. Kynoch, Ltd., Lion Works, Witton, Birmingham.—Leaflet describing their self-oiling bearings, which require refilling only about once a year.

Messrs. F. W. Berk & Co., Ltd., 1, Fenchurch Avenue, E.C.—Leaflet relating to their "B.A.A." (best accumulator acid).

Messrs. W. Watson & Sons, Ltd., 313, High Holborn, W.C.—New price list of apparatus for electrotherapy; the fourteenth edition, admirably illustrated, and containing full particulars of the firm's intensified induction coils, moto-magnetic and other interrupters, transformer, switch and control boards, X-ray tubes and accessories of various kinds. An accompanying pamphlet contains useful "Hints on the Use of X-Ray Apparatus," constituting a practical handbook for use in connection with the apparatus listed, and giving data for the exposure, development, &c., of X-ray photographs.

Trade Announcements.—Mr. Geo. W. Beattie has taken over the business of Chandler & Co., electricians, &c., of 6, Lonsdale Terrace, Kew Gardens, Richmond-on-Thames.

Messrs. Everett, Edgcumbe & Co., Ltd., inform us that owing to the increase of their business, the London offices were removed on the 14th inst. from 87 to 117, Victoria Street, Westminster, S.W., where all communications should be addressed in future. Telephone Nos. and Telegraphic Address remain unaltered.

Rippingille Manufacturing Co., Ltd., Plume Street, Aston, Birmingham.—Mr. J. R. Hill has been appointed Receiver for the debenture-holder. The business will be carried on as usual for the present. Particulars of claims should be sent to the Receiver at the above address.

Messrs. Nobtons (Tividale), Ltd., inform us that they have opened a London office at 145, Cannon Street, E.C., which will be in charge of Mr. C. J. Seaman, M.Inst.M.E, who has had many years' experience in connection with colliery equipment.

LIGHTING and POWER NOTES.

Acton.—Our local correspondent says:—"Under the new and more businesslike conditions set up six months ago, the undertaking has more than paid its way, and though burdened by a loss of £1,404 in the first quarter (under the old conditions), the year's working is likely to result in only a very trifling deficit. For the quarter ended December 31st there was a profit over the working expenses of £1,903, and, after paying £1,224, instalment of loan and interest, it left a profit of £679 upon the quarter's working of the undertaking. This is the first time a net profit has been made. Taking the six months' working, since the new rate of charges came into effect, the net profit is £234, the balance over working expenses being £2,683, and the half-yearly instalments on loans and interest £2,449. One is led to remark that if this can be done in the face of the organised opposition which has been directed against the undertaking by a section of the Council, what can be done if the Council unitedly pull together for the benefit of the concern and the ratepayers?"

Ashton-under-Lyne.—The T.C. has received from the L.G.B. sanction for a loan of £1,940 for the extension of the plant at the electricity works.

Bootle.—The T.C. has decided to carry out extensions to the plant at the electricity works at a cost of £2,520, which will be met out of the reserve and renewal funds. The new plant, &c., to be provided is:—Switchboard renewal, £1,300; winding Nos. 1 and 2 generators and spare armature, £300; circulating pump, £276; reversible booster, £425; battery alterations, £100; balancer, rewinding, £120.

Brazil.—The Ministry of Justice and Home Affairs has been authorised to purchase, among other things, electric and hygienic installations for the new police building in the Federal District, and apparatus for the same purpose in respect of the new Law College at Recife (Pernambuco).—*Board of Trade Journal.*

Brixham.—The U.D.C. has resolved to support the application of Messrs. R. A. Lister & Co., of Brixham and Dursley, for a prov. order for E.L. The Council has also sealed an agreement with the firm for public lighting by electricity.

Bury St. Edmund's.—The T.C. has decided to hire out metal-filament lamps for exterior shop lighting, at £1 per annum for each lantern with lamps of 300 c.p., this to include the supply, fixing and maintenance of the lamps. Current will be charged for at 6d. per unit.

Camberley.—At a recent meeting of the U.D.C., it was decided to obtain the views of the ratepayers as to the Council's electric lighting proposals, by means of "reply-paid" postcards; at the same meeting it was decided also to get independent expert advice as to the scheme from a well-known firm who had offered to report on the whole matter for a sum of 20 guineas.

Canada.—A big scheme of power development is involved in a petition which has been presented to the House of Commons, and upon which a Bill will be founded incorporating the Ottawa and Montreal Power Transmission Co. The incorporators are chiefly Ottawa capitalists. Power is sought to transmit power to Montreal, also to cross the Ottawa River in order to supply the power demand in Ottawa and other towns. The capitalisation is placed at $500,000, with powers to increase it from time to time. The company has acquired several water powers, and if legislation is secured, will purchase others on the Ottawa and Gatineau Rivers.

Cardiff.—According to a local correspondent, the City Council has received sanctions from the L.G.B. to borrow £11,046, repayable in 17 years, for additional plant at the Roath power station, and £5,672, repayable in 24 years, to defray expenses on mains. It has also been under discussion to spend £8,000 in repairing the tramway tracks.

Carmarthen.—The Carmarthen Electric Lighting Co. has given six months' notice of its intention to supply the borough with electricity for public lighting. The works are to be situated on vacant ground above the Fair Ground.

Carlisle.—The plant at the electricity works is to be considerably extended to enable the T.C. to supply energy to the works of Messrs. Cowans, Sheldon & Co., Ltd., and Messrs. Ferguson Bros., Ltd., the estimated cost of the extensions is £14,000, and a loan for this sum has been applied for.

Cheltenham.—The T.C. has, by appeal, secured a reduction in the assessment of the electricity works from £3,200 to £2,400.

Dundee.—The Electricity Department is seeking increased borrowing powers. At present the Department is overborrowed to the extent of £14,861, and to meet this and the estimated capital expenditure up to April 30th, 1913, borrowing powers to the extent of £59,291 are required.

The new electrical station at Carolina is to be formally opened on Wednesday, February 23rd, by Prof. James Alfred Ewing, C.B., Director of Naval Education.

Ealing.—The Metropolitan Electric Supply Co. has asked the T.C. to provide a supply of electricity in bulk for a period of about six months from March 10th next for use in Hanwell. The Council has offered to furnish the supply at 4½d. per unit, but will not incur any expenditure in providing the same.

Epsom.—For the quarter ending December 31st, 1909, the accounts presented by the consulting engineer of the electrical undertaking, show that the income from public lighting was £542, compared with £534 in the corresponding period of last year, and from private lighting £1,188, compared with £964. The accounts show receipts £1,740, and expenditure £745, the surplus on the quarter being £994.

Great Baddow.—The Electric Supply Corporation has applied to the R.D.C. for permission to use aerial mains for supplying consumers at Baddow, as the cost of underground mains is prohibitive.

Greystones.—A deputation of the Rathdown R.D.C. No. 2 waited this week on the Greystones Electric Light Co. with reference to the public lighting at Greystones. The deputation said that the ratepayers of the district would not sanction a higher rate than 3d. in the £ for electric lighting. The matter was adjourned till the next meeting of the Council. It has been decided to electrically light the new Carnegie Library which is being built at Greystones.

Hanwell.—Electrical mains are now being laid along the main roads, the Council undertaking the work in its agreement with the Metropolitan Electric Supply Co. It will be recalled that, having obtained a provisional order, at a cost of about £550, and then finding that the expense of establishing an electric lighting plant would not be warranted, the Council disposed of the order for payment of the money it expended in getting it.

Hemel Hempstead.—The T.C. has given conditional sanction to the application of the Chesham Electric Light and Power Co., Ltd., for a prov. order for the extension of the lighting area so as to include the borough and the parishes of Bovingdon and King's Langley.

Hendon.—The Hendon Electric Supply Co. recently applied to the Council in reference to a proposal for lighting a part of Golder's Green with flame arc lamps, 12 in number, and for consent to the erection of the necessary standards, to which the Council agreed.

India.—According to *Commercial Intelligence*, the question of introducing electric lighting into Lucknow has been under the consideration of the municipality since 1905, when a concession was given to a company to introduce a scheme of tramways and electric lighting. The company was unable to find the necessary capital, and their concession was revoked last August. Since then tenders have been invited for a fresh scheme, in Europe, America and India, but, in the absence of a thorough survey, no

satisfactory tender could be made. It has now been arranged that an expert shall get out a detailed scheme for the guidance of firms who may wish to take up the concession. The municipality may, however, eventually decide to carry out the undertaking itself.

Lancashire Mill Electrification.—In a recent editorial dealing with electrical progress in Lancashire, the *Manchester Evening News* refers to the marked advance in the use of electrical power in the Bolton mills. Many small industries have introduced electrical driving and several large mills of the Bolton Fine Spinners' Combine have been converted, while several more are in the hands of electrical contractors. The article states that Oldham has done nothing in the matter, but at Radcliffe the largest mill is receiving attention at the hands of the Lancs. Power Co. Our contemporary remarks that the partial collapse of the cotton trade and its effect on the allied trades, accounts for the hopes of big developments during the year, not being realised.

London. — HAMMERSMITH. — According to figures furnished by the Electricity Committee, the amounts required to be raised by loan for work approved, and the estimate of capital expenditure during the year ending March 31st, 1911, are respectively £5,226 and £6,774. Application is to be made to the L.C.C. for sanction to loans of both these amounts.

WESTMINSTER.—The Westminster Electric Supply Corporation has asked to be allowed to put up an experimental installation consisting of 12 metallic-filament lamps at the west end of Victoria Street, and four flame arc lamps erected at the east end of the street. In view of the fact that the contracts for low-pressure gas lighting terminate on March 31st next, the Committee has accepted the offer, subject to the Corporation bearing the whole cost. The Committee has also received a proposal from the St. James's and Pall Mall Electric Light Co., to erect an experimental installation of flame arc lamps in Sackville Street which is now lighted by incandescent gas lamps, provided the Council will bear half the cost of such installation. The Committee has agreed to the company's proposal, subject to their bearing the whole cost of, and incidental to, the installation.

Lowestoft.—It having been reported to the Electricity Committee that a private company contemplated supplying electricity to Pakefield and Kessingland—next Lowestoft—the Committee recommended to the T.C. that it should apply for a provisional order for the district. This met with much opposition at the Council meeting, mainly owing to the distance of Kessingland from the generating station, and to the fact that no data as to cost and estimated income were presented. The question was accordingly referred back to the Committee for further consideration and report.

Newcastle-under-Lyme.—We understand from Mr. De Renzi, the engineer, that the question of applying for a loan of £300 for cable extensions has been deferred until after the annual meeting in March next, and has not, therefore, been decided on, as mentioned in our last issue.

Nuneaton.—The T.C. has decided to apply for a loan of £2,155 for cable extensions, street lighting, services, &c.

Pinner.—The B. of T. has revoked the Pinner, Stanmore, Harrow Weald and Edgware Electric Lighting Order, 1906.

Pontefract.—The B. of G. has under consideration the question of increasing the electric lighting at the workhouse by the installation of metallic-filament lamps, and the provision of a motor-generator to reduce the voltage from 200 to 100. By this means an annual saving of £126 is anticipated.

Rugby.—A L.G.B. inquiry was held on the 15th inst. into the application of the Council for sanction to borrow £5,500 for extensions of plant, &c. Under agreement with the B.T.-H. Co., who supply the Council, the latter is required to make extensions when the load exceeds 200 KW., as it has recently done. On the advice of the Inspector the application was reduced to £5,180, viz.: Additional plant, £1,460; mains, £2,800; services, £600; and transformers, £320.

Short Heath.—The U.D.C. has asked the Midland Electric Corporation to favourably consider an extension of the mains to the district.

South Bank.—The U.D.C. has decided to approach the Cleveland Electric Power Co. and to ascertain if there is any possibility of its being able to supply electricity in the district in the near future at a price similar to or below that now paid for gas.

U.S.A.—It is intended to commence work shortly on a hydro-electric plant at Keokuk on the Mississippi River, with a view to supplying energy to the City of St. Louis. The work is estimated to cost 2½ million pounds.—*Board of Trade Journal.*

Walsall.—The balance-sheet of the Corporation's electricity undertaking for the year ended December shows a net profit of £652 19s., compared with a net loss of £856 12s. for the previous year. The Committee expresses satisfaction at the result of the year's working.

Whitwood (Yorks.).—The E.L. question has again been before the U.D.C., which has had three schemes and estimates placed before it. The largest of the schemes, which provides for the lighting of the whole of the town, is favoured, but the matter has been referred to a special meeting.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—As the outcome of the protracted discussion extending over some months, regarding the price to be charged to the Suburban Tramways Co., the T.C. has offered to charge 1·75d. per unit for five years from June 23rd last, the company to guarantee a minimum annual consumption of 140,000 units; in the event of the company disagreeing, the T.C. will take proceedings to enforce its award.

Blyth.—At a meeting of the Urban Council on the 10th inst., it was decided to appoint a Committee to consider the initiation of a scheme of electrical tramways between Blyth and Whitley Bay.

Bacup.—In connection with various schemes for the development of Bacup, the Light Railway Commissioners have agreed to a scheme, costing £24,000, for an electric tramway from Bacup to Shawforth, while the Corporation is to borrow £3,000 for the electric lighting of the borough.

Black Country.—Mr. J. A. Lycett, the managing director of the B.E.T. Co., has intimated to the West Bromwich Tradesmen's Association and to the Trades Council that he is prepared to receive a deputation from these bodies respecting the "fair fare" question. Meanwhile the boycott of the cars continues, and as an evidence of the hold the movement has taken on the populace, it may be mentioned that the discontented travellers, or rather non-travellers, are now wearing badges in their button-holes. The fare question was discussed at Brierley Hill U.D.C. last week, and a resolution passed protesting against the innovation; appealing to the company to revert forthwith to the old stages; to adopt the 1d. fares for any mile of the tramway; and to again reintroduce the half fares for children. At the Edgley U.D.C. last week the clerk announced the receipt of a memorial, signed by persons using the trams, protesting against the increase in the charge for workmen's weekly tickets available between the Bull Ring and Bilston Town Hall from 1s. 6d. to 2s. It was decided to forward the memorial to Mr. Lycett. The Kingswinford U.D.C. and the Wednesbury T.C. have also discussed the "fair fare" recently, and strongly resent the alteration.

Carshalton.—The U.D.C. recently wrote to the B. of T. asking for some action to be taken with reference to the "fair fare" system introduced by the South Metropolitan Tramways Co. The company has since informed the Board that it is under no obligation to submit fares for the Council's approval other than those within the Council's area. After discussing the letter, the Council decided to write to the Board stating that it did not accept the company's interpretation of its obligations, and asking the Board to deal with the matter. It may be mentioned that there is great opposition in the locality to the new system.

Continental Notes. — GERMANY. — Apart from the electric railway schemes projected by the suburban towns of Charlottenburg, Schoneberg and Wilmsdorf, there are at present four projects under consideration which still await a decision. The first is the elevated and underground railway contemplated by the municipality between the north and the south; the second is the tunnel scheme of the Berlin Grand Tramways Co.; the third is the north-south line suggested by the A.E.G.; and the fourth is a suspended railway proposed by the Continental Electrical Enterprise Co., also to connect the northern and southern parts of the city. According to a communication apparently emanating from circles associated with the latter company, the object of a high-speed railway should be to transport passengers as quickly as possible at the lowest possible fare in order to render the railway of advantage to all sections of the community, whilst, at the same time, it should be remunerative to the owners, whether a company or a local authority. It is considered that the existing elevated and underground railway is unable to fulfil these conditions in regard to extensions as the cost of construction of the new underground sections amounts to £645,000 per mile, and the cost of high level sections in the eastern and northern suburbs is also very high, whereas the requisite amount of traffic could only be secured in these districts, having regard to the population concerned, by the adoption of very low fares and cheap season and workmen's tickets. It is contended from the experience hitherto gained in Berlin that a fast railway which cost over £242,000 per mile, would be unable to offer a low uniform fare and cheap tickets for workmen and season ticket holders and be remunerative. In the case of the north-south scheme of the A.E.G., it is said, the cost would exceed £480,000 per mile, but the suspended railway would only necessitate a normal expenditure which, in the instance of the Barmen-Elberfeld line, amounted to £80,000 per mile.

SWITZERLAND.—A French syndicate is interested in a project to construct an electric railway between Thun and Interlaken, on the north bank of Lake Thun. The line is estimated to cost £150,000.

RUSSIA.—Plans are being prepared in respect of a projected electric tramway between Sebastopol and Jalta.

DENMARK.—The Copenhagen municipality has under consideration a proposal to raise a loan of 60 million crowns for the purchase of the electric tramways in the city.

AUSTRIA.—The Agram Tramways Co. is increasing its capital with the object of converting its tramways in the town of Agram (Croatia) to electric traction.

A company is being formed by the Austrian Credit Anstalt for the construction of the projected Mittenwald electric

railway from Wilte near Innsbruck, to Scharnitz, on the Bavarian frontier. The company has a share capital of £504,000, which is being subscribed by the State, the Province of Tyrol, and the City of Innsbruck, whilst the Credit Anstalt takes over bonds representing £618,000. The railway will be worked by the State, which will defer the charge for operating expenses in order to guarantee the interest service on the bonds.

Dundee.—The Corporation is to experiment with vestibules to protect car drivers from severe weather on the more exposed routes. A Birkenhead firm is supplying the vestibules at £18 10s. per car.

Dunfermline.—A start is shortly to be made by the Dunfermline and District Tramway Co. with the construction of a line to Kelty, and this will be followed by an extension to Glencraig.

Devonport.—The T.C. has presented a petition against the Devonport and District Tramways Bill, which is being promoted in the House of Commons to amend the Devonport and District Tramways Act, 1898. In the course of the petition it is stated that it is proposed by the Bill to repeal or cancel a number of the most important and essential provisions in the Act of 1898 and the lease granted by the Corporation to the company; and the petitioners contend that it is entirely contrary to the practice of Parliament to sanction the wholesale alteration of agreements entered into, after full discussion and for valuable consideration, particularly when the petitioners have expended a sum exceeding £62,000 upon the construction of the tramways on the faith of such agreements. The petitioners are informed and believe that the company has been financed and controlled by the B.E.T. Co., and that the object of repealing Sub-Sec. 3 of Sec. 8 of the Act is to enable the last mentioned company to make financial arrangements for its own advantage and without any regard to the interests of the public.

Fife.—In connection with the local tramway extensions the Fife Electric Power Co. has completed the installation of a 2,000-H.P. 6,600-volt vertical Curtis turbine in its Townhill station, this, we understand, being the first turbine of this type in Scotland.

Glasgow.—The extension of the Corporation system from Mount Florida to Holmlea Road is progressing rapidly, and will be ready for opening some time next month. When finished, the line will give a direct route from Glasgow Cross to Cathcart. For some time past, residents in Busby—a suburb of Glasgow—have been approaching the T.C. Tramways Department for an extension of the car lines from Cathcart—a distance of about 3 miles. The County Council has stated its willingness to favourably consider application for the use of the roads, but the Tramways Committee, while stating that the matter has not been finally shelved, deem it inadvisable to make any further extension meantime.

Lowestoft.—The T.C. has been informed that the time for completing the East Anglian Light Railways has been extended to January 31st, 1912.

Halesowen.—The Light Railway Co. having applied for sanction to various proposed extensions of its system, an inquiry on behalf of the B. of T. was held on Tuesday. It was explained to the Commissioners that in 1901 and 1902, Light Railways Orders were obtained by the Halesowen U.D.C., and that after considerable negotiations these were transferred to Mr. George Balfour. With respect to the line objected to (No. 5), it was pointed out that it would traverse a portion of Beech Lanes, and would connect with the existing tramway to Birmingham at the King's Head. So far as the local authorities were concerned, the ownership of the road was somewhat peculiar. They had the boundaries upon that short route of the Worcestershire, Staffordshire and Warwickshire County Councils, the city of Birmingham, the borough of Smethwick and the urban district of Oldbury. It was, therefore, suggested that where they found the road in the possession of so many authorities, the Commissioners should place the tramway powers in the hands of a company. The Commissioners intimated they had come to the conclusion that the proposed extensions were indispensable, and were in favour of of the application being granted, but they also considered that the order should be given to the Birmingham, Oldbury and Smethwick authorities. They adjourned the inquiry to enable satisfactory terms to be arrived at. At the conclusion of the inquiry, the Chairman expressed the hope of the Commissioners that the light railway would be speedily constructed.

Short Heath.—The Walsall T.C. has decided not to entertain the request of the U.D.C. for the extension of the tramways to Short Heath, owing to the small population along the route.

Southend-on-Sea.—The T.C. has decided to purchase six additional single-truck cars, each to carry from 54 to 58 passengers, at an estimated cost of £3,500.

Tranvaal.—The Pretoria Council is considering a proposed £1,000,000 loan for various municipal enterprises, including tramway extensions estimated to cost £150,000.

Walsall.—The net profit on the Corporation's tramway undertaking for the year 1909 amounts to £3,144, and it is to be carried to the reserve fund now standing at £23,000. In 1908 the net profit was £3,680, and in 1907 £4,305, so that there is on last year's working a considerable reduction of the profits as compared with both those years. As a matter of fact, the profit last year is the second lowest amount made since the Corporation took over the tramways six years ago. The shrinkage is believed to be entirely due to trade depression. It should be added that an allowance has been made of £514, the second instalment towards the cost of four new cars which are being paid for out of revenue.

TELEGRAPH and TELEPHONE NOTES.

Cable Interrupted and Repaired.—Accra-Lagos, interrupted February 9th; repaired February 11th.

Mackay Companies.—The annual report of the Mackay Companies issued on Tuesday, states that it will sell its entire holding of stock in the American Telephone and Telegraph Co., that step being in deference to public opinion, which views with suspicion this large holding of stock in a company which has recently purchased the control of the Western Union Telegraph Co. Moreover, that stock was acquired by the Mackay Companies with a view to bringing about economies in the construction and maintenance of joint pole lines over long stretches of country, where the business was not sufficient to justify either company in constructing an independent pole line by itself. Many such arrangements were made, each company owning one-half of the pole line, but having nothing to do with the business of the other company. Since, however, the American Telephone and Telegraph Co. has acquired control of the Western Union Telegraph Co., the time has come for the Mackay Companies to sell its holdings of stock in the American Telephone and Telegraph Co., and that will be done. The postal telegraph system will continue to be free and independent, prepared to maintain the competition which it has furnished for 25 years.—*Reuter.*

Naval Secrets.—The trial of R. S. Knowlden, a draughtsman employed on H.M.S. *Vernon*, previously referred to, took place on the 9th inst., at Winchester Assizes. According to the *Daily Telegraph*, there were two indictments for larceny, and one under the Official Secrets Act. The larceny indictments alleged that he stole certain wireless telegraph apparatus, drawings, sketches, note-books, plans, tracings, and other articles, together of the value of £20, the property of the King, at Portsmouth, in the years 1908 and 1909. The prisoner plead not guilty to the larceny indictments, but admitted the indictment under the Official Secrets Act. It was stated that the prisoner, who was a married man, was very zealous to get on in his profession, and took away apparatus and drawings to work up his knowledge of wireless telegraphy. He had no intention of stealing any of these things or of betraying any secret, and he had no treasonable design whatever, though his conduct had been most indiscreet. The Solicitor-General said the case was a grave one. It was most important that Admiralty secrets should not be procured in this way. He was quiet prepared to accept counsel's contention that prisoner's motives were quite innocent, but his motives made no real difference to the case. Still he was quite prepared to leave the matter in the hands of his Lordship. Mr. Justice Lawrance agreed with the course taken by the prosecution not to go on with the larceny charges. Prisoner was bound over in £250, and one surety of the same amount.

Southern Nigeria.—In the Blue Book just presented to the Colonial Office by the Governor, on the development of Southern Nigeria, it is stated that there was an increase of 48·5 per cent. in the number of telegrams dealt with in 1908 compared with 1907. A telephone exchange was established at Calabar, and the telephone system at Lagos reconstructed. Various local telephone systems were established, and 120 miles of line.

Telephone Rates.—At a recent meeting in London the Association of Municipal Corporations decided "now to press the Government, so that when the undertaking of the National Telephone Co., Ltd., has been taken over, the service may continue at rates very considerably below those at present charged."

Wireless Telegraphy.—There is to be erected at Washington, U.S.A., a wireless installation costing £60,000, which is to keep the capital in touch with American warships at a distance of 3,000 miles.

The Chinese Administration has opened a wireless telegraph station at Shanghai, but as it is restricted to messages in the English language only, this being contrary to the Radio-Telegraphic Convention, local messages only will be handled. There exist now two stations in Egypt, one at Port Said and the other at Tewfik, both of which are reserved for maritime purposes.

CONTRACTS OPEN and CLOSED.

OPEN.

Algeria.—March 10th. The Prefectural authorities at Oran are inviting tenders for a concession for the construction and working of an electric tramway between Oran and El Ancor.

Australia.—Melbourne.—Seven sections of branching multiple-magneto switchboard for the P.M.G. See "Official Notices" January 7th.

Sydney.—March 9th. Magneto-switchboards for metallic lines and switchboards for private branch exchanges for common-battery working, in accordance with schedule N.S.W.E.E., 114/09 for the P.M.G. Departmental Stores.

Tasmania.—Seventeen cordless switchboards for the P.M.G. Forms, &c., can be obtained at the Commonwealth Offices, London.

Victoria.—1,640 tubular iron or steel poles for the P.M.G. Forms, &c., can be obtained at the Commonwealth Offices, London.

Telephone switchboards for New South Wales, and poles (iron or steel) for Western Australia, for the P.M.G. See "Official Notices" February 4th.

Wire testing machine, for the P.M.G.'s department in Western Australia. See "Official Notices" February 4th.

One electrically-driven dust extractor for the P.M.G.'s Department in Queensland. See "Official Notices" February 11th.

Beckenham.—February 21st. House cut-outs and service boxes, for the U.D.C.

Belfast.—February 21st. Low-tension insulated V.R. cable for one year, for the Tramways and Electricity Department. See "Official Notices" January 28th.

A year's stores for the Tramways and Electricity Committee. See "Official Notices" January 28th.

Belgium.—March 5th. The municipal authorities of Ghent are inviting tenders for the construction of three electric cranes at the Port of Ghent.

Birmingham.—March 8th. Electrical accessories for a year, for the Birmingham, Tame and Rea District Drainage Board. J. D. Watson, engineer, to the Board, Tyborn, near Birmingham.

Blackpool.—2,500 yd. of ·5 low-tension single cable (600 volts) for the Electricity Department. See "Official Notices" January 28th.

Bolton.—March 5th. Materials and stores for the Tramways Committee. See "Official Notices" to-day.

Bristol.—March 8th. Stores for the Corporation. See "Official Notices" to-day.

Carlisle.—March 1st. Two 500-KW. reciprocating steam engine-driven dynamo sets, with ejector condensers for the Corporation. See "Official Notices" February 11th.

Dublin.—February 23rd. Arc lamp carbons for the Corporation. See "Official Notices" to-day.

March 2nd.—Extra-high-pressure and low-pressure cables for the Corporation. See "Official Notices" to-day.

Germany.—February 23rd. The Prussian State Railway authorities in Altona are inviting tenders for the supply of 357,940 arc lamp carbons.

Glasgow.—Tenders are to be called for the supply of stores to the Electricity Department for 12 months from June 1st next.

Gillingham.—February 28th. Cables, lamps, meters, &c., for the Council; iron oil tank. See two "Official Notices" February 11th.

Gravesend.—February 28th. Supplies for a year for the T.C. Electricity Works.

Hereford.—February 26th. Installation of fire alarm bells at the Herefordshire Training College. See "Official Notices" February 11th.

Heston and Isleworth.—March 1st. Stores for a year for the U.D.C. See "Official Notices" to-day.

Hornsey.—February 19th. Meters, cables, &c., for the T.C. See "Official Notices" February 4th.

Hungary.—March 30th. Tenders are being invited by the municipal authorities of Szigetvar for the establishment of a central electric lighting station in the town.

Ilford.—February 22nd. Meters, cables, lamps, carbons, &c., for the Electricity Works, for one year. See "Official Notices" February 11th.

Kingston-upon-Hull.—March 10th. Telephone instruments for the Council. See "Official Notices" to-day.

Leeds.—February 28th. Annual contracts for coal, cables, meters and other stores for the Corporation. See "Official Notices" January 28th.

London.—L.C.C.—February 23rd. Wiring and fittings for the electric lighting of a number of elementary schools. See "Official Notices" February 11th.

St. Pancras.—February 28th. Arc lamp carbons for the B.C. See "Official Notices" January 28th.

Battersea.—Stores for a year for the B.C. See "Official Notices" to-day.

Fulham.—March 2nd. Stores for the B.C. See "Official Notices" to-day.

Hammersmith.—Tenders are to be invited for the supply of eight transformers for delivery in April. One of 250 KW., one of 200 KW. and six of 100 KW. each.

Manchester.—February 22nd. General stores for the Tramway Department. See "Official Notices" February 11th.

Newport (Mon.).—March 8th. E.L. fittings for the Board of Guardians. I. Thomas, clerk, Queen's Hill.

Roumania.—March 15th. The municipal authorities of Tecuieu are inviting tenders for the concession for the electric lighting of the town.

Spain.—March 14th. 60 years' tramway concession in north-east Barcelona—from the Calle de Caspe to Vallcarca. Tenders to Dirección General de Obras Publicas, Ministerio de Fomento. Deposit £216. Local representation necessary. An application already lodged will have preferential rights. For further particulars see *Board of Trade Journal*.

March 29th.—The Spanish Ministry of Public Works in Madrid is inviting tenders for a concession for the construction and working of an electric tramway in the town of Santander.

Swindon.—February 26th. Electrical and tramway equipment accessories, fuse and service boxes, &c., for the T.C., for a year. See "Official Notices" February 11th.

Transvaal.—April 2nd. The Government is inviting proposals for the erection of local plant for the manufacture of steel from iron and steel scrap. Particulars to be lodged at the office of the Agent-General for the Transvaal, 72, Victoria Street, S.W., and with the Secretary of Mines, Pretoria, by April 2nd.

Turkey.—February 28th. Electric tramway (construction and working) between Niaousta Town and Station. Ministry of Public Works.

Walthamstow.—February 25th. Stores for the U.D.C. Electricity and Tramways Departments for 12 months. See "Official Notices" February 4th.

Watford.—March 1st. Paper-insulated cables for the U.D.C. Electricity Department. See "Official Notices" February 11th.

Wimbledon.—February 28th. Various materials for the Corporation Electricity Department. See "Official Notices" February 11th.

Wrexham.—March 15th. Stores for the T.C. See "Official Notices" to-day.

CLOSED.

Australia.—The Melbourne City Council Electric Supply Committee has accepted the offer of the Sloan Electrical Supply, Ltd., for the supply, f.o.b. London, of 40,500 flame arc carbons at a cost of £1,945.

Basingstoke.—The T.C. on February 10th accepted the tender of Messrs. Manlove, Alliott & Co., of Nottingham, for a dust destructor, at £1,319.

Brighton.—The Lighting Committee of the T.C. has accepted the following tenders:—

British Westinghouse Electric and Manufacturing Co., Ltd.—Oil switch main and exciter panels, £333 10s.
Wilson, Hartnell & Co.—Motor-driven three-throw oil pump, £215.
Mather & Platt.—Motor-driven centrifugal circulating pump, £79.

Carlisle.—The Electricity Committee has agreed to accept the tenders of the British Insulated and Helsby Cables, Ltd., at £1,127 16s. 7d. for cable, and of the Albion Clay Co., at £428, for cable ducts.

Clacton-on-Sea.—The U.D.C. has accepted the tender of the Electrical Apparatus Co., Ltd., for meters.

Dublin.—The contract for the complete installation of electrical plant and wiring, at the Crooksling Sanatorium, Brittas, County Dublin, for the Dublin Joint Hospital Board, has been secured by the Estate Engineering Co.

India.—The Calcutta Electric Supply Co. has, on the recommendation of its consulting engineers, Messrs. Kennedy and Jenkin, placed an order for a 1,000-KW. Willans impulse "disc and drum" type turbine with Messrs. Willans & Robinson, Ltd., Rugby.

Leyton.—The Council has accepted a number of tenders for ploughs, wearing pieces, brackets, collector bars, springs, &c., for equipping 20 cars on the conduit system. The General Electric Co. are to supply 72 lighting switches and fuses combined, and the British Westinghouse Co., 20 automatic switches, canopy and other switches.

London.—The Metropolitan Asylums Board has accepted the following tenders:—Electric Contracts and Maintenance Co., extension of telephone at the Joyce Green Hospital, £13 1s. 6d. W. H. Fryer & Co, installation of electric light in disinfector house, North-Eastern Hospital, £10 11s.

BERMONDSEY.—The B.C. received the following tenders for feeder panels:—

British Thomson-Houston Co., Ltd.	£70	7	6
Crompton & Co..	103	5	0
General Electric Co., Ltd.	68	17	6
Siemens Bros. .. .. (accepted)	91	0	0

STEPNEY.—The B.C. has adopted the recommendations of the Electricity Supply Committee as to the tenders mentioned on page 218 of our last issue.

HAMMERSMITH.—The B.C. has accepted the following tenders:—General Electric Co., circuit breakers, £21 10s. Universal Electric Manufacturing Co., fuseboard, £16 18s. G. Ellison, switches for motors at present hired to Messrs. Gwynnes, £67 8s. 6d. British Electric Transformer Co., hiring to Council, six 100-KW. transformers, £280 for the period of the exhibition.

HAMPSTEAD.—The B.C. has accepted the tender of Pryke and Palmer for the annual supply of engineers' stores for the electric lighting station

L.C.C.—The Highways Committee recommends the acceptance of the following tenders for work in connection with the tramways:—Bolckow, Vaughan & Co., Ltd., at £21,065, for the supply of about 3,000 tons of track rails and fastenings. P. and W. Maclellan, Ltd., at £12,386, for the supply of 1,500 tons of slot rails and conductor tees. Hadfield's Steel Foundry Co., Ltd., at £14,432 10s., for special trackwork.

In connection with the Woolwich to Eltham tramways it is recommended that the offers of Hurst, Nelson & Co., Ltd. and the British Westinghouse Electric and Manufacturing Co., Ltd., totalling £8,580, be accepted for the construction of 10 cars carrying from 60 to 62 passengers each.

Spagnoletti, Ltd. have tendered for the supply of additional H and L.T. switchgear for the Elephant and Castle sub-station, at £120, and this offer is recommended for acceptance.

The following tenders have been received from selected firms for the supply of test room instruments for the second section of the central car repair depôt:—

Everett, Edgcumbe & Co., Ltd.	£103	4	2
India-Rubber, Gutta-Percha & Tel. Works Co., Ltd.	111	1	6
Evershed & Vignoles, Ltd.	116	3	1
Nalder Bros. & Thompson, Ltd.	119	9	0

The tender of Messrs. Everett, Edgcumbe & Co. is recommended for acceptance.

The tender of Buck & Hickman, Ltd., at £87 19s. 6d., for paint shop machinery at the central car depôt, is recommended for acceptance.

The contract for the electric lighting of the new premises of the Institution of Electrical Engineers on the Embankment has been placed with Messrs. Drake & Gorham, Ltd., at £1,018.

Metropolitan Railway Co.—The tender of the General Electric Co., Ltd., has been accepted for the annual supply of Osram lamps.

Newcastle-on-Tyne.—The Tramways Committee on the 10th inst. agreed to recommend the City Council to accept the tender of Mr. J. W. Courtenay, of Norfolk Street, London, for the advertising rights on the tramways.

Plymouth.—The T.C. has accepted the following tenders for the supply of electrical apparatus at the Technical Institute:—

Rhodes Motors Co.	£42	15	0
Johnson & Phillips	22	8	0
Union Electric Co.	11	10	0
" "	4	10	0
Elliott Bros.	3	4	0
" "	3	7	3
Crompton & Co.	5	16	0
" "	3	3	6
Everett & Co.	19	2	9
British Westinghouse Co	2	15	0

Russia.—La Societe Mecanique Russo-Baltique, of Riga, has just secured a contract for the construction of 60 tramcars with electric motor equipments for the electric tramways in Moscow.

Worksop.—The U.D.C. has accepted the tender of the Craigpark Electric Cable Co., Ltd., for cables, at £416.

FORTHCOMING EVENTS.

Tramways and Light Railways Association.—Saturday, February 18th. At 7 p.m. At the Gaiety Restaurant. Annual general meeting. Annual dinner and smoking concert at 7.30 for 7.45.

Institution of Electrical Engineers (Glasgow Students' Section).—Friday, February 18th. At 8 p.m. At the Technical College, Glasgow. Paper on "Protective Devices for High-Tension Mains," by Mr. C. Rissik.

Institution of Civil Engineers.—Tuesday, February 22nd. At 8 p.m. Paper on "The Hudson River Tunnels of the Hudson and Manhattan Railroad Co.," by Mr. C. M. Jacobs.

Institution of Electrical Engineers (Manchester Section).—Tuesday, February 22nd. At 7.30 p.m. At the University, Manchester. Paper on "The Present Aspect of Electric Lighting," by H. W. Handcock and A. H. Dykes.
Friday, February 25th. At 7.15 p.m. At the Midland Hotel, Manchester. Annual Dinner.

Institution of Electrical Engineers (Leeds Local Section).—Wednesday, February 23rd. At 7.15 p.m. At the University, Leeds. Paper, "Notes on Overhead Lines," by Mr. W. B. Woodhouse.

National Electrical Manufacturers' Association.—Tuesday, February 22nd. At 2.30 p.m. At the Association Offices. Annual General Meeting.

Royal Institution.—Thursday, February 24th. At 3 p.m. Lecture on "Illumination, Natural and Artificial," by Prof. S. P. Thompson. (Lecture II.)
Saturday, February 26th. At 3 p.m. Lecture on "Electric Waves and the Electromagnetic Theory of Light," by Prof. Sir J. J. Thomson.

Physical Society.—Friday, February 25th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "Telephone Circuits," by Prof. J. Perry; and "The Laws regarding the Direction of Thermo-Electric Currents Enunciated by M. Thomas," by Prof. C. H. Lees.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

THE following orders are issued:—

Commanding Officer—COL. R. E. B. CROMPTON, C.B.

Monday, February 21st.—"A" Company. Recruits' infantry drill, 6 to 7 p.m.; technical drill, 7 to 9.30 p.m.

Tuesday, February 22nd.—"B" Company. Technical drill, 7 to 9.30 p.m.

Wednesday, February 23rd.—Gymnasium, 6.30 to 9.30 p.m.

Thursday, February 24th.—"C" Company. Technical drill, 7 to 9.30 p.m.

Friday, February 25th.—"D" Company. Recruits' infantry drill, 6 to 7 p.m.; technical drill, 7 to 8.45 p.m.; infantry drill, 8.45 to 9.45 p.m.

Saturday, February 26th.—"B" Company. Week-end run at Coalhouse Fort. Parade at Fenchurch Street Station, 3.15 p.m. Dress as usual.

(Signed) P. H. CAMPBELL, Capt. R.E. and Adjutant.
For O.C. E.E., L.D.

NOTES.

Electrical Trades Benevolent Fund Dinner.—There is yet time for those who had the intention of being present, but who may have overlooked the date of the dinner in aid of the Electrical Trades Benevolent Fund. It is to be held on the evening of the 23rd inst., in the Whitehall Rooms of the Hotel Metropole, with Dr. Gisbert Kapp, President of the Institution of Electrical Engineers, in the chair. We have so many times enlarged upon the objects of this Institution, that our readers may think we are looking forward to being the first annuitants when the funds have accumulated to a sufficiently large figure to enable the Committee, primarily, to grant pensions to deserving cases; the other object being temporary relief to those whose claims, when examined, are deemed to be genuinely in need of immediate pecuniary assistance.

There is, however, a misapprehension in many minds regarding this fund. Why, say some, do you need further money to hoard up when so few applicants appeal for aid? You already have a good sum at your disposal, and, like the fund of the Institution of Electrical Engineers, you do nothing with it!

But those who argue thus forget that only the interest can, at present, be used for the purposes of the fund, and this has already been disbursed to several claimants with the exception of some £10 to £12, since the date of last year's dinner.

Donations and subscriptions are needed to build up the capital, until the interest becomes sufficiently great to provide for pensions, which, as we have said, is the object dearest to the hearts of those who are doing their best towards the realisation of this ideal.

Annual Dinner.—The first annual dinner of the staff of Ferranti, Ltd., was held at the Grand Hotel, Manchester, on Friday, February 4th, Mr. A. B. Anderson, the managing director, presiding. About 70 members of the staff were present. The chairman, in proposing the toast, "The Ferranti Co.," compared its history to that of the first-born of a fond parent—the fond parent being Mr. Ferranti—which contracted an illness. Experienced practitioners were brought in—Mr. W. W. Tait and Mr. Arthur Whittaker—who performed an operation. These gentlemen were appointed to a "Medical Board," and Mr. Henderson was added, and Mr. Anderson appointed as "head nurse," and with the help of the whole board, the "patient" was making a complete recovery. The dinner was followed by a musical programme, and the evening passed off with the greatest success.

Institution and Lecture Notes.—MINING INSTITUTE OF SCOTLAND.—At a general meeting held in Glasgow on the 9th inst., a paper recently contributed by Mr. Robert Nelson, H.M. Electrical Inspector of Mines, on the subject of "Electricity in Mines" was discussed. Mr. R. W. Dron said that a good many electricians, including Mr. Nelson, were trying to force the question of the use of alternating current and armoured cables, but in speaking to many practical colliery managers he found that they did not desire these innovations. These managers had been using direct current for a number of years, and they did not consider these particular proposals of Mr. Nelson's to be in the interests of the safety either of the men or the mine. He did not think they should be forced to adopt plant and appliances that were suitable for a central installation on the surface, but quite unsuited to the conditions that obtained in underground work. Mr. G. L. Kerr said Mr. Nelson wanted to install alternating current in all the pits where safety lamps were in use. He thought, however, that he did not wish to enforce alternating current in collieries where the naked light was in vogue. Then he desired armoured cables throughout. From talks he had had with electrical engineers and mining managers he understood that these proposals were not regarded as very practical. The discussion was adjourned.

PHYSICAL SOCIETY.—The dinner of this Society was held on Tuesday evening last week, when Dr. C. Chree, F.R.S. (president) welcomed a number of distinguished Fellows and guests. After the loyal toasts had been duly honoured, Prof. Silvanus Thompson proposed the toast of "Our Guests," and recalled the early days of Guthrie and original members, of whom Prof. Carey Foster, Mr. Shaw and Prof. Reinold were the only representatives there that evening. Sir Archibald Geikie, in replying, referred to the importance of the work of the Physical Society as a training ground for the Royal Society. Mr. Ogilvie also responded to this toast.

In proposing the toast of the "Physical Society," Mr. Bateson said that he had become very much impressed with the view that the problems encountered by physiologists would not be solved until the physicist came to their assistance. Dr. Chree, in responding to the toast, referred generally to the work of the Society and to its increasing activity. The number of papers read before the Society had become much larger of recent years, but he thought there might be some improvement in the presentation of such papers. Papers usually consisted of 25 per cent. due to the author, and 75 per cent. of material that preceded the paper. Authors were apt to neglect the 75 per cent., and to assume that the audience knew all about it. Also, if any mathematics appeared in a paper, the author generally proceeded to put it upon the blackboard. This was not desirable, because a physicist's knowledge of mathematics was usually not good, and mathematical results were frequently not of great value. In some ways it might be better for authors to read each other's papers instead of their own. Prof. H. L. Callendar also responded to this toast, and gave a humorous account of his duties as treasurer.

ASSOCIATION OF TECHNICAL INSTITUTIONS.—The 17th annual meeting was opened on the 11th inst., about 80 delegates being present. Dr. R. T. Glazebrook, the new president, delivered an address, in which he expressed the view that our modern universities in general would do for England what the technical high schools had done for Germany; but the Imperial Technical College would probably become the technical university for London. The meeting closed on Saturday, and a visit was paid to the National Physical Laboratory.

ILLUMINATING ENGINEERING SOCIETY.—The first annual dinner of the Society took place on the 10th inst., Sir H. T. Wood presiding in the absence of Prof. S. P. Thompson, who was unwell. Among those present were Mr. W. M. Mordey, Mr. A. P. Trotter, Mr. Leon Gaster (founder and hon. sec. of the Society), and other well-known men.

JUNIOR INSTITUTION OF ENGINEERS.—The twenty-sixth annual dinner of the Institution was held on Saturday last at the Hotel Cecil. The President, Eng.-Vice-Admiral H. J. Oram, C.B., was in the chair, and there were about 150 present, including Sir Philip Watts, K.C.B. (Chief Constructor to the Navy), Mr. J. W. Helps, Eng.-Capt. G. C. Goodwin, R.N. (Deputy Engineer-in-Chief to the Fleet), Sir J. Durston, and others named below.

After the loyal toasts, Dr. Macnamara proposed the toast of "Engineering and National Defence," emphasising the importance of the part played by the engineer since the commencement of the nineteenth century; our naval defence, he said, depended to an ever-increasing degree upon his ability. Brain was overhauling brawn, and our supremacy must be maintained by the adoption of scientific methods. Sir W. H. White, in reply, remarked that the highly-placed technical officers were not highly remunerated. Engineers were first so-called in connection with the Army, where, as in the Navy nowadays, they took all the risks without any of the excitement enjoyed by the military branch. There was no branch of engineering which had not played its part in the national defence. But in the end all depended upon "the man behind the gun"—the skilled operators and users of the wonderful mechanism that engineers had placed at their disposal. Mr. J. Swinburne proposed "Steam Turbine Propulsion," paying a tribute to the genius of the Hon. C. A. Parsons, to whom the invention was wholly due. He related a new version of the alleged nightmare which he had experienced when Mr. Parsons took him on board a submarine vessel with a spiral fin on the outside, revolving at 500 R.P.M., while the propeller revolved in the opposite direction at the same speed, thus solving the problem of coupling a turbine at 1,000 R.P.M. to a propeller at 500 R.P.M. His adventures on board this gimblet craft were weird and entertaining, including the perforation of a *Dreadnought*. To overcome the peculiar gyrostatic tendencies of the vessel it had to be steered by an Irishman, who naturally steered always at right angles to the direction intended, thus securing the desired end. Vice-Admiral Oram (a passenger in bishop's uniform) expressed a preference for trolley wires laid upon the bottom; but conversation was restricted by centrifugal force, which not only plastered the crew against the shell, but held their jaws open when they got over the dead centre.

Mr. Summers Hunter (President of the N.E. Coast Institution of Engineers), in reply, remarked that Mr. Parsons was still engaged in experimental work, and that a vessel would soon be afloat with a quite different arrangement of turbines, which would constitute a very important development. The adoption of the turbine in the mercantile marine was of the utmost importance, to secure increased economy. Great developments might be looked for in the near future.

The Right Hon. Lord Pirrie toasted "The Junior Institution of Engineers," of which he had been invited to become president, his refusal being due only to the heavy responsibility of producing two great vessels of 60,000 tons displacement and 40,000 H.P., 800 ft. long. The Admiralty should encourage the building of great docks to receive such ships, far ahead of the shipbuilding programme—ample dock accommodation was indispensable. London would be the greatest port in the world if properly provided in this respect. His firm would welcome the Institution to Ireland in the summer.

Mr. G. T. Bullock, chairman of the Institution, in his reply, referred to the pleasure with which they looked forward to the Irish visit. He emphasised the importance of the social side of the Institution's work and of the assistance it rendered to all its members at home and abroad, numbering over 1,000.

Mr. J. W. Nisbet, vice-chairman, proposed the health of the President, who replied in a humorous speech, in the course of which he pointed out the indebtedness of the Institution to the secretary. Mr. W. T. Dunn, who was received with acclamation, briefly acknowledged the toast. The speeches were interspersed with an excellent musical programme.

At a recent meeting of the Institution the Honorary Member's Lecture of the year was delivered by Mr. R. H. Heenan, M.Inst.C.E., on "The Creation and Development of a Successful Commercial Port."

INSTITUTION OF ELECTRICAL ENGINEERS (GLASGOW LOCAL SECTION).—The annual smoking concert was held in the Banqueting Hall of "The Grosvenor" on Saturday evening last, Mr. E. G. Tidd presiding.

BIRMINGHAM UNIVERSITY ENGINEERING SOCIETY.—Sir Oliver Lodge lectured last week on "Protection from Lightning."

COVENTRY ENGINEERING SOCIETY.—Mr. E. Kilburn Scott lectured on "Uses of Electric Motors for Driving Purposes," on Friday last, giving an interesting description of many methods by which electric motors may be used to advantage in the driving of all kinds of machinery.

Appointment Vacant.—Telegraph mechanician, for the Lagos Railway, Southern Nigeria. See our advertisement pages in this issue.

Meters.—It has been brought to the attention of the British Thomson-Houston Co., Ltd., that certain statements are being made to the effect that the B.T.-H. type H H. mercury meter for continuous-current circuits, and types A.C.T. and R.H. for alternating-current circuits, are manufactured abroad. They desire to state that these are all manufactured at their works at Rugby, and any report to the contrary is false.

Ending the Eight Hours Strike.—The Northumberland Miners' Executive on Thursday issued a circular to the lodges announcing their determination to end the eight hours strike, and ordering the striking collieries to seek an interview with the respective managements and endeavour to arrive at a settlement.

New Copper Mine.—According to the Newfoundland correspondent of the *Standard*, an extensive find of peacock copper ore of high quality has been made to the north of Longpoint, in Notre Dame Bay. The new field is in the same area as Tilt Cove, long famous for its high-grade copper ore, and the surveys indicate that the deposits extend over many square miles, and can be worked at a comparatively small outlay. There is here a splendid opening for English capitalists. An assay of the newly-found ore shows that it yields nearly 40 per cent. of pure copper.

New Mining Motors and Switchgear.—On the invitation of Messrs. Mavor & Coulson, Ltd., Glasgow, the members of the Mining Institute of Scotland, to the number of 150, visited, on the 9th inst., the firm's works, and inspected a number of new electrical appliances suited to mining operations. While the exhibits included many types of coal-cutters, chief interest centred round a new completely-enclosed, air-cooled safety mining motor, together with a special display of switch boxes, fuse boxes, and gate-end boxes with safety plugs.

The new type of mining motor is adapted to both D.C. and three-phase systems. The shell and end covers are made exceptionally strong, and all the joints are flame proof. The windings and shell of the motor are cooled by an arrangement of fans and circulating tubes. Two fans are fitted to the motor shaft, one being inside and one outside the shell. A number of tubes pass through the motor

between the field coils, and are fixed at each end to the end covers of the motors, the ends of the tubes being open to the atmosphere. The principle of the arrangement is analogous to that of a steam condenser. The heated air in the motor is cooled by contact with the surface of the tubes through which the cool outer air is circulated by the fan fixed outside the motor casing. Every portion of the enclosed air is brought into contact with the tubes by the fan inside the motor casing.

The gate-end boxes are of the three-pole, two-pole and single-pole types, the last-named being used in conjunction with "c c." concentric wiring. Each box contains a switch, fuse and socket for trailing cable plug. The box is of cast-iron with closed back, and a broad machined flange in front. The cover is fitted with loose hinges which permit of the machined surfaces being pressed closely together by the wing nuts. The switches are of the double-break and quick-break type, insulated with micanite, the external handles being insulated by vulcanite sheathing. The fuses are mounted on the same porcelain bases as their corresponding switches, the line of parts for each pole being on an independent base. The fuse holders are of porcelain, of substantial design with massive contacts, and each has marked upon its terminals the current carrying capacity of the fuse it contains. The terminals for receiving the trailing cable are mounted on a porcelain block fixed in the end of the switch and fuse box. A cast-iron extension protects them from mechanical damage and forms a socket to receive the pummel or terminal plug of the trailing cable. An "earthing" connection is provided for the trailing cable. The gate-end boxes are fitted with a simple interlocking device which prevents the opening of the box or the withdrawal of the plug until the switch is at the "off" position. It also prevents the closing of the switch until the lid is closed and the plug inserted.

Airships and Wireless Telegraphy.—A correspondent of the *Frankfürter Zeitung*, writing from Friedrichshafen under the initials of Dr. E., states that the possibility has largely been doubted of equipping metallic airships, particularly the Zeppelin type, with equipment for wireless telegraphy, at least for the dispatch of messages. Since the disaster near Echterdingen, the causes of which have not yet been explained, the easy ignition of the aluminium airship has been considered as a proved fact. But the experiments with wireless telegraphy, which were recently brought to a conclusion, have shown that no airship is better suited for wireless telegraphing with the spark system than the metallic airship. The experiments were naturally carried out with the greatest possible caution, and, in the first place, preliminary trials were made during the past summer in order to determine the possibility of electrical ignition of the Zeppelin ships. The result was, so to say, a negative one, as it was shown to be impossible to bring about the ignition in an artificial way, which is alleged to have been produced near Echterdingen in a natural manner. If such really took place there, quite an abnormal chain of various factors must have been present, such as would, perhaps, never again arise. As a consequence, the opinion entertained at Friedrichshafen inclines in the direction that the spark which ignited the airship near Echterdingen was not electrical, but was caused in a mechanical way, by impact. On the determination of this highly important fact, the actual experiments were commenced, and it was then scarcely surprising that no dangerous occurrences were manifested. The experimenters operated with power up to 1 KW., without any danger to the airship. In this connection, the experience was interesting and valuable in the sense that it was possible to obtain with equal power, a much greater range, and much greater effect in a rigid metallic airship than at land stations or in other airships. On the one hand, there was even lacking the loss through earth conductor, and on the other, the enormous metallic frame of the airship could be utilised as a counter capacity as compared with the extensive wire network of land stations. Thus it was possible to effect connection with a power of only 700 watts up to distances of 372 miles and over; communication was effected with Munich, Strassburg, Metz and Nauen, and even with Norddeich and Frankfort-on-Main. But it can safely be assumed that communication can be effected considerably beyond these distances with only a small increase in power, which is not dangerous, and with longer waves. Practice will soon give valuable indications in reference to the length of the antennæ, the length of the waves, the height of the airship, &c., in order to attain the best possible results. As far as the comprehensibility of the signs received is concerned, it was found that only tone sparks can be well and safely received; with the slower spark signals the the noise and rattling in the car make themselves perceptibly disturbing. The correspondent adds that the higher the airship sailed the better was the understanding, that the longest waves were the best for transmission, and that waves of 1,000 metres were the most suitable for reception.

Shock Fatalities.—At Auckland Park Colliery, Durham, on Saturday, an inquest was held on W. H. Proud, an electrician in charge of a hauling engine at the pit. He was found dead in the engine house, with his knees drawn up. The body looked normal, and there were no signs of burning. Dr. Fielder, who made a post-mortem examination, said that the symptoms were consonant with those shown in the case of death from electrical shock. The evidence of electrical experts showed that there was no flaw in the electrical apparatus. A verdict of Death from Electrical Shock was returned.

An inquest was held on the 11th inst. at Stirling, in respect of the death of J. M'Naught, foreman in charge of a coal-cutting machine, at Polmaise Colliery. The verdict was that the accident was due to some defect in the machine.

Radium and Polonium.—Sir Wm. Ramsay, in the course of an interesting address to the Authors' Club, recently stated that it was quite certain that radium cured rodent ulcer. Whether it would cure cancer was questionable.

Madame Curie has succeeded, with great difficulty, in isolating 0·1 mgm. of polonium, which is found to be far more intensely radio-active than radium, and loses half its weight in 140 days.

The Paris Floods.—The electrical service of Paris was seriously affected by the recent floods; several of the sub-stations which receive polyphase current from the St. Denis generating station at 12,500 volts were invaded by the water, and as the high-pressure cables enter the basements of these stations, the supply was naturally cut off. The Metropolitan Railway also suffered, the generating station at Bercy being within the flooded area, and several of the tramway sub-stations were put out of use. Water also obtained access to many of the cable ducts and did much damage. Almost all the large generating stations which had been built on the banks of the Seine for the sake of coal and water facilities were flooded; the works of the Sector of the Champs-Elysées, at Levallois, was, however, kept running, in spite of the flood. An attempt at Asnières to build a dam of sacks of cement proved unsuccessful. Many private installations were also submerged, and on the whole, according to *l'Industrie Electrique*, the electrical industry in Paris has undergone a severe and costly trial.

Patent Application.—According to notice in the *London Gazette*, the FAHNESTOCK ELECTRIC CO. have applied for the restoration of Patent No. 17,879, of 1903, granted to John Schade, jun., for "Improvements in spring terminal clips for electric conductors." The patent expired in October, 1907, owing to the non-payment of the renewal fee.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. A. A. DAY, electrical engineer and tramways manager, of Bolton, who was knocked down and seriously injured by a car on the 5th inst., is now progressing favourably.

Much sympathy has recently been extended to the borough electrical engineer of Hastings, MR. R. B. FERGUSON, and his wife, on the sad and sudden death of their son (MR ROSS BARBOUR FERGUSON), a promising electrical and engineering student at the Glasgow Technical College.

Woolwich Borough Council, at their last meeting, filled the vacancy caused by the resignation of Mr. C. P. Bowmaker, one of the junior charge engineers of the electricity department. The electrical engineer, in accordance with the Council's Standing Orders, reported as to the qualifications of the switchboard attendants and engine drivers for satisfactorily carrying out the duties of junior charge engineer, and upon his recommendation MR. C. HOBSON, at present one of the switchboard attendants, was appointed at a salary of £100 a year, rising by annual increments of £10 to £140.

General.—MR. JOSEPH PEARCE STOCKBRIDGE, A.M.I.E.E., of the staff of Messrs. C. A. Parsons & Co., of Newcastle-on-Tyne, was recently married at Jesmond Parish Church to Miss Mary Arnott Sisson, eldest daughter of Mr. Jas. Arnott Sisson, also of Newcastle. Amongst the presents was a silver rose bowl from the staff at the Heaton Works.

MR C. J. HENRY, who for some years has been in charge of the Publicity Department of the General Electric Co., Ltd., a position which he has filled with exceptional ability and success, thanks largely to his pleasing personality and address, has decided to take up farming in Canada; he has our best wishes for his future prosperity, though we greatly regret his departure. His successor is MR. H. CLIFFORD PALMER, who formerly occupied the same position.

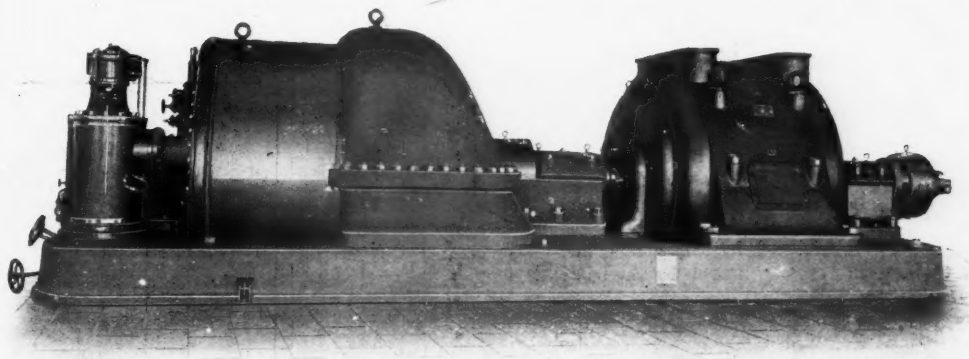
MR. E. GODFREY BREWER, M.I.Mech.E., who recently dissolved partnership with Mr. E. R. Calthrop, and has now established himself as a consulting engineer at 56, Victoria Street, Westminster, S.W., desires to inform his numerous clients and friends that he is in no way related to, or connected with, the Mr. Brewer, of Westminster, who recently figured prominently in the Divorce Court.

Obituary.—MR. W. R. GREEN.—The death is announced of Mr. Wm. Robert Green, a director of the firm of R. Waygood and Co., Ltd., electric lift manufacturers. The deceased gentleman, who was 71 years of age, had been associated with the firm since 1857.

THE DICK, KERR - BERGMANN STEAM TURBINE.

With the opening of the year 1910, the well-known firm of Dick, Kerr & Co. must be added to the already lengthy list of steam turbine manufacturers.

As our readers are well aware, Messrs. Dick, Kerr have attained to the front rank in matters pertaining to heavy electrical engineering, and the output of the Preston works has made for itself a world-wide reputation for excellence.



General View of a 6,000-kw. Turbo-Alternator.

In view of the steadily increasing popularity of the turbo-generator and the success which has attended this branch of Messrs. Dick, Kerr's business, the firm have arranged with the Bergmann-Elektricitäts-Werke A.G. to manufacture turbines under their patents and designs, and so can offer a machine which has passed the experimental stage, and has, indeed, been proved by Continental experience, to be a very successful prime mover; these turbines will be constructed at the firm's Preston works.

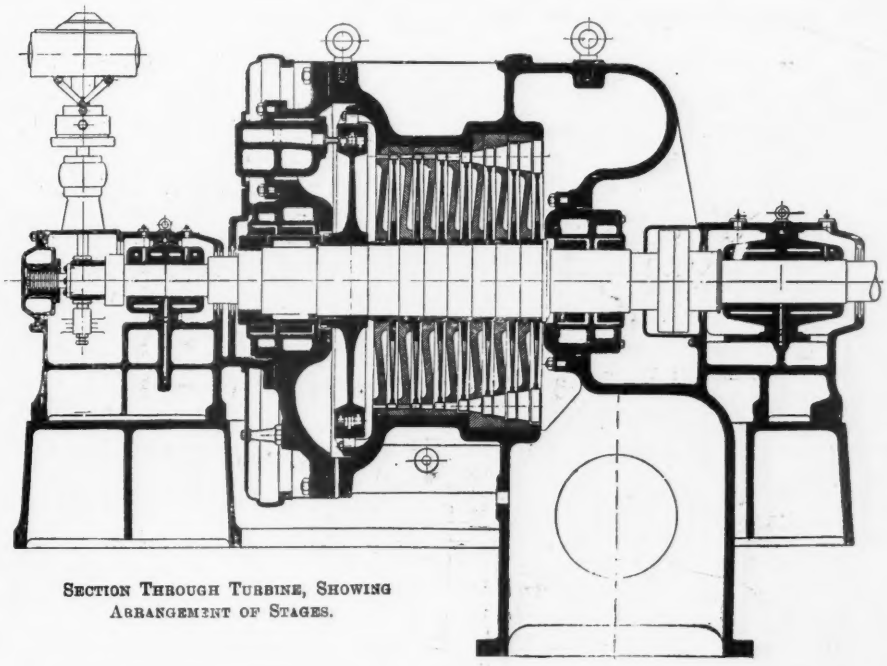
The Dick, Kerr-Bergmann turbine is of the "impulse" type, the power being developed in successive stages, each comprising a guiding and moving part in the shape of disks with special blades fitted to their peripheries.

The guide blades simply give the proper direction to the steam, and adjust its expansion for the required velocity; the moving blades extract the velocity component of the steam, and as no expansion takes place in them, no difference of pressure exists between the inlet and outlet sides. This construction facilitates the use of large clearances; partial admission can be used, and with higher peripheral speeds, a greater fall of temperature in each stage, and a considerable reduction in the number of stages becomes possible.

Further, there is an entire absence of axial thrust, and on these grounds the impulse turbine permits of a much simpler construction. Reference to the sectional view of the Dick, Kerr-Bergmann turbine, shows that the first wheel differs in construction from the others, being designed to take advantage of the principle of velocity stages. This wheel carries two series of blades on its periphery, separated from one another by a few centimetres, the gap being occupied by reversing guide blades which are carried on the turbine body.

After the steam has passed the first series of blades, it is deflected by the reversing vanes back to its original direction, and then loses its remaining velocity in the second series of blades. With this arrangement it is possible to economically utilise high steam velocity, and thereby also large pressure difference at the usual peripheral speeds of an impulse turbine. According to the requirements, from 5 to 15 pressure stages or chambers are employed, the first chamber being a velocity stage; this results in a short machine, and reduced weights.

Curves showing the distribution of steam pressure and steam velocity are given on page 266. Up to the largest sizes, the turbine body consists of a single cast-iron cylinder split horizontally in the centre, and supported freely on the flange surrounding the exhaust end of the lower cylinder; the outer bearing pedestal at the H.P. end carries the



Section Through Turbine, Showing Arrangement of Stages.

governor, oil pump and guide block. The joints of the cylinder are scraped to a steam-tight fit, and the several diaphragms or guide wheels, through the centre of which the turbine shaft passes, are provided with special white metal sealing rings, which enclose the shaft and are provided with grooves to reduce the steam leakage between neighbouring chambers to a minimum.

The adoption of the principle of velocity stages in the first chamber largely eliminates sealing difficulties there, owing to the reduced pressure obtaining; the seal employed consists of a central portion provided with a series of circumferential rings mounted on and rotating with the turbine shaft, and a second portion, fixed to the turbine body, with internal rings fitting into the spaces between the rings on the central part. The rings are arranged in two series with a space between, this space being coupled to the space in a similar sealing device at the condenser end of the turbine. The suction of the condenser draws steam from the high-pressure seal to the low-pressure seal, and thence to the condenser itself.

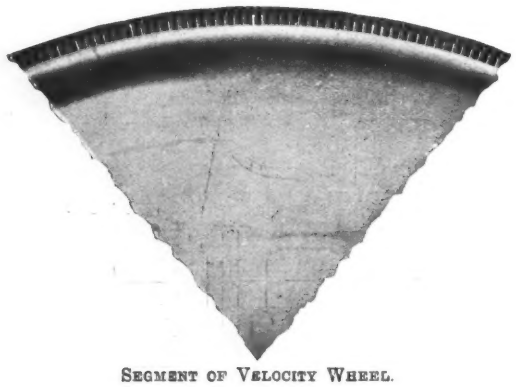
Any loss of steam introduced by this arrangement has been found to be entirely compensated by the frictionless construction.

From 10 to 20 nozzles adjacent to the throttle valve, take the place of guide vanes and regulate the steam admission to about one-quarter of the periphery of the velocity wheel, and the following two or three pressure stages also have partial admission.

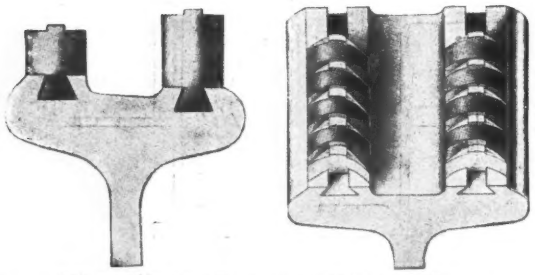
The details of the guide and rotating wheels do not materially differ from other impulse turbines; the guide vanes are of sheet nickel cast into the periphery of the guide wheels, and the latter are in halves with horizontal steam-tight joints and fit into grooves in the cylinder.

The rotating wheels are complete Siemens-Martin steel disks, cast with thickened hubs to enable them to be firmly attached to the shaft; the first or velocity wheel has a bulb-shaped rim, into which the two series of nickel steel blades are dovetailed, and the ends of the blades subsequently closed by means of thin circumferential bands riveted to the latter. Interchangeability is secured by making the blading standard for all wheels and turbines.

A series of tests to destruction has been carried out on this form of blading. Completely riveted-up blades were



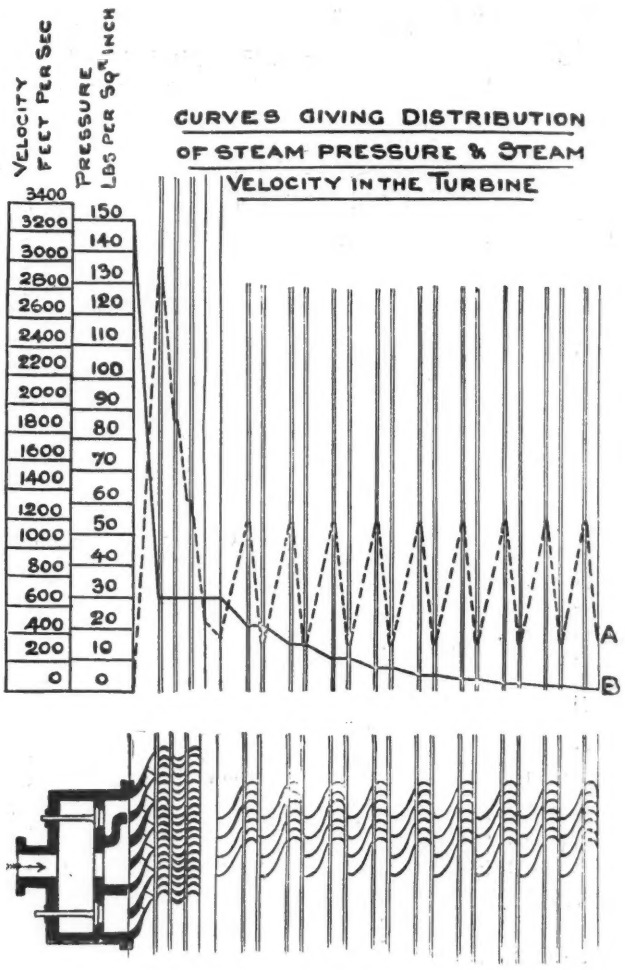
Segment of Velocity Wheel.



Arrangement of Blading on Velocity Wheel.

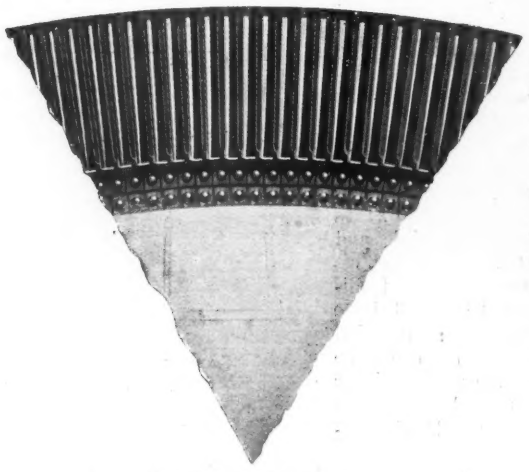
tested by tension between the wheel disk and the top of the blades, changes of form at the bottom of the blades first occurring at about 2,860 lb, and breakage following, quite regularly, between 5,070 and 5,500 lb.; as under working conditions the strain due to centrifugal force on the base of the blades does not exceed 330 lb. in the worst case, it is evident that a very high factor of safety exists.

The bearings are provided with water-cooled oil pressure



Curve A = Steam Velocity. Curve B = Steam Pressure.

lubrication, supplied from a small geared pump driven direct from the turbine shaft; small units are very simply constructed with three bearings and a rigid coupling between generator and turbine, but for larger units, four bearings are



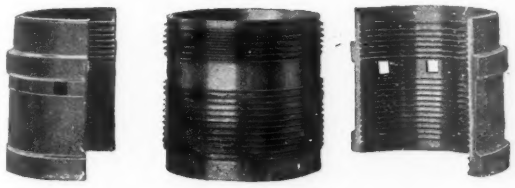
Segment of L.P. Wheel.

fitted and a flexible coupling is used consisting of a number of fine steel wires, which allow for any inaccuracies in the alignment of the shafts.

The governor is spring-controlled and of the Hartung type,

worm-driven from the turbine shaft, and as previously mentioned, it controls the throttle through an auxiliary oil system. Provision is made for adjusting the speed 4 or 5 per cent. above or below the normal, and the possibility of adjusting the first set of guide blades by hand obviates the relatively high steam consumptions at light loads, which usually obtain with throttle governing.

A safety device is provided with each turbine, which closes the main stop valve as soon as the normal speed is exceeded by more than 10 per cent.; the arrangement is carried direct on the main shaft without intermediate gearing, in order to secure reliable working under all circumstances.



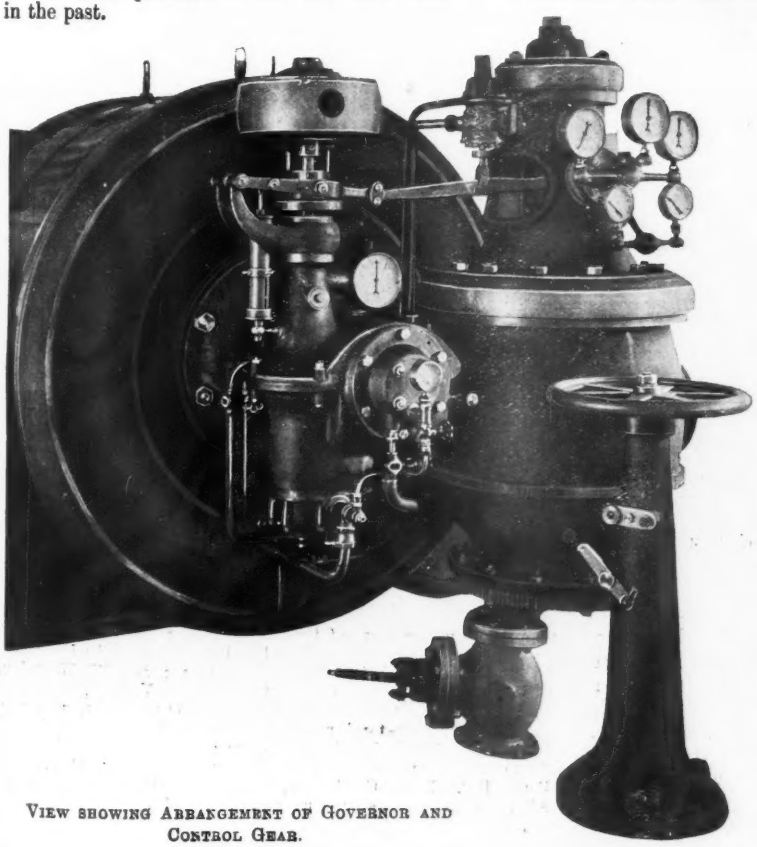
Labyrinth Sealing Device.

At the free end of the turbine shaft, a small thrust block is fixed, which ensures the accurate centring of the rotor.

In addition to high-pressure turbines, Messrs. Dick, Kerr are prepared to construct both the exhaust and mixed pressure types of machine, and these also have been standardised.

The chief difference in the construction of the purely exhaust turbine is in the suppression of the velocity stage, and a slightly different form of bearing at the steam admission end.

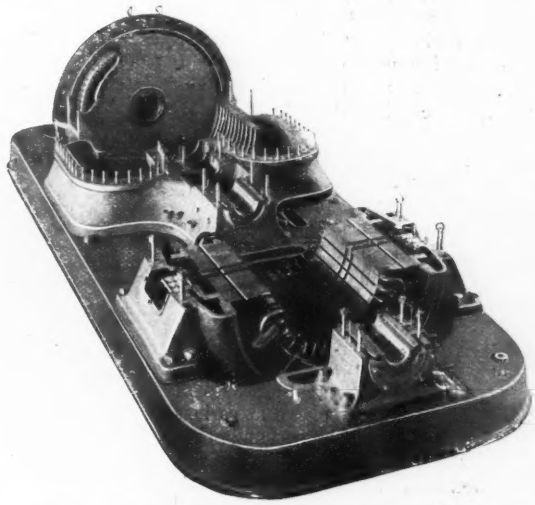
It is almost unnecessary to add that Messrs. Dick, Kerr are well equipped for the new venture, the Preston works being one of the most modern and best equipped in the country, and doubtless the Dick, Kerr-Bergmann turbine will figure as succesfully in the future as the other products of the firm have done in the past.



View showing Arrangement of Governor and Control Gear.

A NEW ELECTRICAL PLANING MACHINE DRIVE.

During the past few years several electrical systems of driving planing machines and other reciprocating tools have been introduced, all more or less with the object of using



Lower Half of Turbine showing Admission Nozzles in End Cover.

A Standard Rotor, showing Velocity Wheel and Sealing Devices.

higher speeds, obtaining accurate reversal and eliminating belt slip, and consequent loss of power.

To attain these ends more completely, the Lancashire Dynamo and Motor Co. have recently introduced an electrical drive, which differs in several important points from its predecessors.

This arrangement, known as the Lancashire system, employs a reversing motor, and consists of a motor-generator, running at a high speed, mounted on the machine, or in any convenient position; the motor end is supplied with either alternating or direct current, and if no current is available, the special generator may be driven from a line shaft.

The generator end is connected electrically direct to the planer motor, which is direct coupled or geared to the planer-driving shaft. The generator and planer motor are direct-current machines, and wound for any convenient voltage.

A reversing switch is actuated by a tappet rod from the reversing gear of the planer, and when this is thrown over, it reverses the direction of the current in the field winding of the generator, thus reversing the direction of rotation of the planer motor, and at the same time it so regulates the voltage of the generator by which the speed of the planer motor is decided, as to cause the planer motor to run at the

speed required according to whether it is on the cutting or return stroke.

By hand regulation of a resistance in the generator field, the cutting speed may be varied from 15 ft. per minute or less, to the full return speed of the planer—the maximum cutting speed depending, of course, on what the tool will stand.

The system is a truly regenerative one, as the energy stored in the planer table and its load, as well as that stored in the revolving parts of the planer and motor, is returned to the circuit at each reversal, by causing the planer motor to become a generator at this instant, and to give out energy through the motor-generator to the line.

This not only results in a considerable saving in power, but a very powerful braking effect is introduced, which causes the motor to reverse instantaneously.

The switchgear is simple, and only the reversing switch, which operates at each reversal of the planer, and deals with the small field current of the generator, is in continuous use. Small switches in the field circuit can be placed at various points round the machine, and thus facilitate the control.

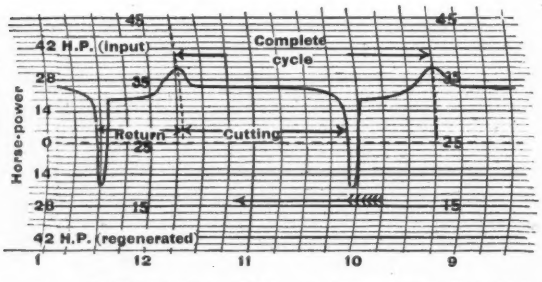
The following table shows the result of a trial on a planer recently electrified on this system :—

Test of 6 *ft.* × 6 *ft.* × 18 *ft. planer.*

Weight of table	=	8·5 tons.
„ „ castings on table	=	2·5 „
Total	=	11·0 „

Size of planer under test.	Length of stroke taken.	Time of 10 cycles.	Speed of cutting	Speed of return.	Waste time per cycle.
ft. in.	in.	min. sec.	ft. per min.	ft. per min	sec.
18 × 6	15·16	3 56	54	176	1·8
	10·25	2 41	54	176	1·3
	·5	1 28	54	176	1·5
	2·16	49	54	176	1·7

A feature of this system is the absolute accuracy of the reversal ; at any speed and with the table loaded or unloaded,

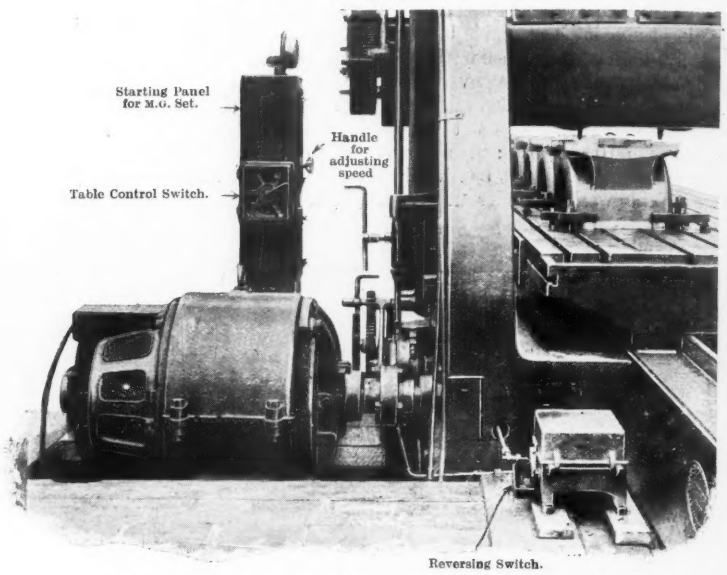


Cutting Speed = 80 ft. per min. 2 — ½" × ⅛" cuts
Return Speed = 160 ft. per min. (mild steel)

POWER CURVE OF ELECTRIC DRIVE ON THE "LANCASHIRE" SYSTEM.

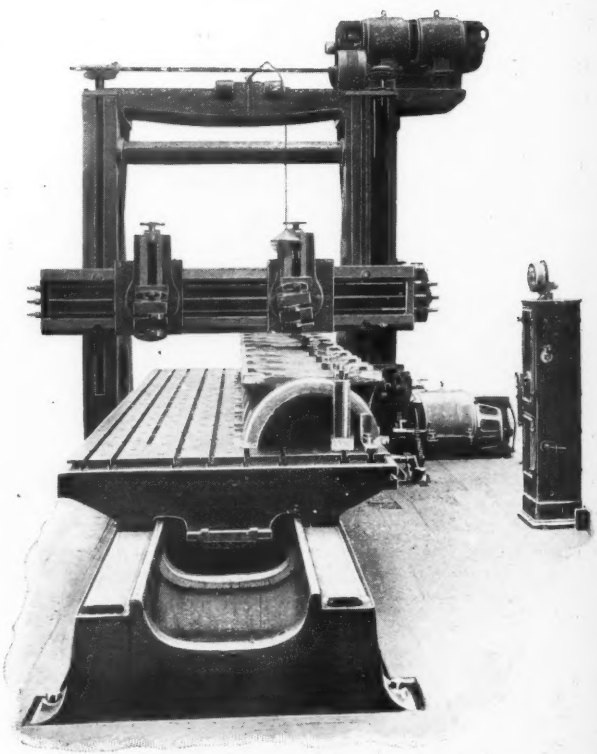
a planer will plane up to a line—the exact control being due to the regenerative system, which also results in a minimum power consumption. Very little switchgear is required ; the panel shown in our view is an ordinary starting panel, the hand-wheel regulating the cutting speed and the case at the side containing a switch for starting and stopping the planer motor, for tool changing, &c. The reversing switch is also shown in one of our views.

Correction.—The annual dinner and general meeting of the Tramways and Light Railways Association is to be held on Friday, 18th (not Saturday, as stated by us last week).



THE "LANCASHIRE" PLANING MACHINE DRIVE: VIEW OF MACHINE MOTOR AND SWITCHGEAR.

O.S.A. Annual Dinner.—The twelfth annual dinner of the Central Technical College Old Students' Association was held on Saturday last at the Trocadero Restaurant, Mr. H. A. Humphrey, F.C.G.I., being in the chair. Sir Philip Magnus, M.P., in proposing the toast of the Association, referred to the great progress the Central Technical College had made since its inception, and to the invaluable training received there; Mr. W. H. Allen, of Bedford, responded to the toast of the Visitors, and Mr. A. L. C. Fell, of the L.C.C. Tramways Department, was also present. The Secretary's report showed that the membership had increased to 750 during the past year; also that the Employment Agency had been enabled to do much useful work. Prof. W. J. Pope, F.C.G.I., of Cambridge, was elected President for 1910. After the speeches a successful concert was held.



PLANING MACHINE EQUIPPED WITH THE "LANCASHIRE" ELECTRIC DRIVE.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Hobart Electric Tramway Co., Ltd. (35,926).—This company's annual return was filed on December 7th, when 50,270 shares had been taken up out of a nominal capital of £105,000 in £1 shares; £25,790 has been received, and £24,480 is considered as paid. Mortgages and charges: £56,285.

Amazon Telegraph Co., Ltd. (44,532).—This company's annual return was filed on December 15th, when the entire capital of £250,000 in £10 shares had been taken up and paid in full. Mortgages and charges: £197,200.

Delagoa Bay Development Corporation, Ltd. (76,099).—This company's annual return, made up to November 23rd, 1909, has been filed. 267,400 shares had been taken up out of a nominal capital of £300,000 in £1 shares. £1 per share has been called up on 177,400 shares and £177,440 has been received, including £40 paid on 100 shares forfeited. £90,000 is considered as paid. Mortgages and charges: £177,100.

Hampshire Light Railways Electric Co, Ltd. (52,564).—This company's annual return made up to December 24th, 1909, has been filed. The entire capital of £1,000 in £10 shares has been taken up; £1,000 paid. Mortgages and charges: Nil.

Electric Light and Power Co., Ltd. (98,437). — Issue on January 21st of £100 debentures, part of a series of which particulars have already been filed.

Himalaya Electric Railway, Ltd. (59,538).—This company's annual return was filed on January 26th, when the entire capital of £3,000 in £1 shares had been taken up; £3,000 is considered as paid. Mortgages and charges: Nil.

CITY NOTES.

St. James' and Pall Mall Electric Light Co., Ltd.

The report of the directors for the year 1909 states that the supply has been distributed from the Carnaby Street and Mason's Yard works of this company on a total connection of 11,865 kw., being an increase of 136 kw. For this purpose 5,587,351 units were generated at these works, and 5,764,690 units were purchased from the Central Electric Supply Co., Ltd. The Central Electric Supply Co., Ltd., has declared a dividend of 5 per cent. on the ordinary shares, in respect of which a sum of £2,500 will be payable to this company. The directors have materially increased the amount written off to depreciation for 1909, and have transferred from the net revenue of the year a further sum of £3,500 to credit of the contingency fund. The net profits for the year 1909, applicable to dividends on shares, amount to £25,320 7s. 5d.; add balance brought forward from 1908, £3,705 5s. 9d. = £29,025 13s. 2d. Less interim dividend paid in August last for last half-year ending June 30th, at the rate of 7 per cent. on preference shares, £3,500; 10 per cent. on ordinary shares, £10,000 = £13,500. Leaving an amount now to be dealt with of £15,525 13s. 2d. The directors propose to divide this amount as follows:—(*a*) By payment of a dividend at the rate of 7 per cent. on the preference shares for the second half-year, £3,500; (*b*) By payment of a dividend on the ordinary shares for the second half-year of 5s. per share, making, with the interim dividend paid in August last, a total distribution of 10 per cent. for the year, £10,000; (*c*) amount to be carried forward, £2,025 13s. 2d. = £15,525 13s. 2d. Mr. Marlborough R. Pryor and Sir John H. Morris, K.C.S.I., are the directors who retire by rotation under Clause 80 of the articles of association, and, being eligible, offer themselves for re-election.

The annual general meeting of the above company was held on Tuesday at the offices, Carnaby Street, Golden Square, W., under the chairmanship of Mr. Walter Leaf.

In moving the adoption of the report, the Chairman said they had had the advantage during the year of being free from the deplorable waste of energy involved in opposition to Parliamentary schemes. They were no doubt aware that Parliament in 1908 sanctioned a certain Act intended to remove the disabilities of what was known as the association clause in provisional orders. In accordance with this Act, the company had submitted a provisional agreement with the London Electric Supply Corporation to authorise the two companies to enter into arrangements on these lines. The combination of these companies would enable them to carry out their statutory obligations to the public at reduced cost, as the present method of dual capital expenditure for a single district would be no longer required, whilst the interests of the consumers would be entirely safeguarded. The scheme was still under the consideration of the Board of Trade. The result of the year's working might be briefly summarised as follows:—Whilst their total revenue had dropped by £3,229, or 2·7 per cent., they had made a saving in the expenditure of £3,399. But they had found it necessary to set aside an amount for depreciation exceeding their usual provision by about £4 500. After doing this and placing £3,500 as in 1909 to the credit of the contingency fund, they were able to pay the same dividend, and carry forward £2,025 to the next year. The units sold, 9¼ millions, were practically the same as last year, but there was a loss of about 3¼ per cent. in the higher priced units of lighting as against an increase of about 20 per cent. in the units for power sold at a lower price. The falling-off of the units for lighting was due to the increased use of the metal-filament lamp; while causing for a time a loss of revenue, it would in the end be a benefit, as it put them in a more favourable position in regard to competition with modern methods of gas lighting. Their officials were of opinion that they were about half way through the change; it would take two years more before the change was complete. During these two years they must expect a further falling-off of revenue, and then they could reasonably hope that their normal rate of increase would be resumed. This falling-off of revenue might be met in two ways. One way, the most obvious but least desirable, was by increasing their charges. They did not intend to have recourse to this except in one particular way. The output of power had now reached a point where they thought a reasonable increase was justified. They had accordingly advised their power-users that from January 1st of that year a charge of 7s. 6d. per quarter per rated horse-power would be made for motors in addition to the flat rate of 1d. per unit. Their relations with their customers were such that the charge was accepted. The other method was to lower the cost by the adoption of improved methods of production. They would have noticed in the accounts of the Central company a capital expenditure of £67,000 during 1909, and this had been employed in extensive improvements to their plant at Grove Road. New turbo-generators had been installed with their proper complement of condensing plant, so that the exhaust steam could be utilised to the fullest extent. The result was that the consumption of steam per unit generated had been reduced 40 per cent. New boilers had been put in with mechanical stokers, so that bituminous coal could be used instead of Welsh coal, which gave them a larger market and a saving of cost. The new plant was only in operation for one quarter during 1909, so that they confidently looked for a further saving in 1910. They did not intend, however, to rest content with this; their manager and engineer had advised them that the time had come when a further material saving could be effected by boldly scrapping certain portions of their plant at Carnaby Street and at Mason's Yard and placing both stations on a modern and efficient footing. They proposed to remove the whole of the steam generating plant from Mason's Yard station, and to use that station in the future as a transformer sub-station for high-tension supply. By so doing he thought they would be able to take full benefit of the improved plant at Grove Road, and at the same time provide a large reserve to guarantee their customers against any risk of interruption. They proposed also to scrap a number of well-used boilers at Carnaby Street, and to install boilers of the latest pattern fitted with mechanical stokers, so as to be able to use bituminous coal. It was also proposed to extend the buildings at Carnaby Street, so as to house certain of the administrative staff now scattered, and further to economise by better organisation and central control. The cost of this reconstruction could be largely provided for by the sum which had already been written off as depreciation from the original cost of the plant to be displaced, and there would be a further sum to be provided in respect of that portion of the plant which had become obsolete before reaching the end of its normal life. Some of this depreciation was already realised, and it was in respect of this that they were writing off £4,500, in addition to their ordinary charge for depreciation. The rest they hoped to add out of the contingency fund, which was created in order to provide for calls such as this. If their expectations were realised, the economies effected would pay in the next year or two for the whole of the cost of these large improvements, without trenching upon the amounts available for dividend. The shareholders were now reaping the fruits of the support they had given in the past to the policy of ample depreciation, and the board confidently asked for a continuance of that support in the future. The company was never on a sounder basis than at the present day.

Sir J. H. Morris seconded the motion, which was carried without discussion.

A cordial vote of thanks to the staff for their efficient services was carried with acclamation.

Smithfield Markets Electric Supply Co., Ltd.

The report of the directors to be submitted to the annual general meeting on the 24th inst. shows that for the year 1909 the gross profit amounts to £2,152 10s. 1d. and the net profit to £307 11s. 5d. This sum, together with £400, the amount set aside for the premium on redemption of the second mortgage debentures, has been carried to depreciation and reserve fund account, making the total standing to the credit of this account £21,093 14s. 9d. The reduction in gross profit is due entirely to the almost universal adoption of metallic-filament lamps in the Central Markets, which has reduced the receipts from the sale of energy by over £4,000. In order to meet this reduction in revenue the board decided to raise the price of energy for lighting from January 1st of this year. The directors believe that the increased rate will enable them to resume payment of a dividend. In November last the shareholders were informed that a settlement of the negotiations with the Corporation of London for an extension of the company's contract had been arrived at. The new contract extends until December 25th, 1972, a period co-terminous with the date of expiration of the lease of the company's generating station, subject to certain conditions as to purchase of the undertaking in 1932 or 1952. With a view to improving the financial position of the company, it is the intention of the board to pay off the £8,000 of second mortgage debentures now overdue, and to set aside an annual sum to provide for the redemption of the 4 per cent. debenture stock within the period of the extended contract. In these circumstances the directors regret that they are not in a position to recommend the payment of a dividend for the past year. The director retiring by rotation is Mr. J. Browne Martin, who, being eligible, offers himself for re-election.

Northampton Electric Light and Power Co., Ltd.

The report of the directors, to be presented at the annual meeting on the 24th inst., shows that the results of the past year's working have been in every way most satisfactory. Lamps have been added to the number of 4,391, and motors (reckoned as 8-c.p. lamps) 7,800, together 12,191; the horse-power of motors has increased from 1,003 to 1,263, and of this 1,044 h.p. is hired from the company. The mains have increased from 21 miles 664 yards to 23 miles 1,251 yards, besides two feeders laid during the year, totalling 1 mile 1,528 yards. The energy sold for lighting has increased 9¾ per cent. and for power 50 per cent., the total units amounting to 1,418,790; maximum load on plant, 957 kw. (8 per cent. increase); load factor, 16·7. During the past year there has been a considerable extension of buildings and plant, including a boiler and economiser house (with coal bunkers) for two boilers, one of which has now been installed; a new chimney double the capacity of the old one, and a 1,000-h.p. engine and dynamo. The bulk of the output has been dealt with by the new condensing plant, and a considerable reduction of working costs has been thereby effected. To provide funds for the capital outlay, 10,000 ordinary shares were issued, and also debentures to the amount of £2,100. The depreciation account has been increased by £3,000, out of which £500 has been written off accumulators, £500 has been added to reserve and £300 has been written off motors. The sum of £626 will be required for the half-year's dividend on the 5 per cent. preference shares, and the directors propose that 6½ per cent. per annum should be paid on the ordinary shares for the half-year, making 5½ per cent. for the year. This will amount to £1,480 9s. 2d., and there will be £1,053 2s. 3d. to be carried forward. On January 1st next the 4 per cent. debentures will be redeemable, and it is proposed that 4 per cent. debenture stock shall then be created, and that all debenture-holders shall have the opportunity of taking stock in exchange for their debentures. Notice of these proposals will be sent out in due course. Mr. Thornton retires in rotation from the board, and will be proposed for re-election. Mr. J. E. Law will be proposed for re-election as auditor. The directors deplore the loss of their colleague, Mr. Richard Cleaver.

Dublin United Tramways Co., Ltd.

Mr. W. M. Murphy presided at the meeting held at Dublin on February 1st. He moved the adoption of the report which recommended a dividend at the rate of 6 per cent. per annum for the half-year on the ordinary and preference shares, carrying £15,000 to renewal of permanent way fund and £9,267 forward. The chairman said that the increase in receipts was 1½ per cent., which was sufficient to demonstrate that the earning powers of the tramways had still a tendency to expand. They had been trying some experiments with cattle traffic from the Blessington line. If the company had access to the quays a large traffic in coal and other sea-borne merchandise might be developed. The expenses had increased by £580 more than the receipts. This was owing to the heavy charge for the upkeep of permanent way and renewal of curves, points, and crossings, which had cost £3,295 more during the half-year. In the cost of generating electricity there was a saving of £110, though the car-mileage was increased by 70,000 miles. In addition to the increase in permanent way expenses, they had also spent a further sum of £2,672 for relaying with new 105-lb. rails the entire double track from O'Connell's Statue to Dawson Street. This was the first time that they had had occasion to renew any of the rails laid by the Dublin United Tramways Co. in 1897, as distinguished from the rails on the Dalkey line. In the near future it would be necessary to renew the rails from Dawson Street to Merrion Square. The first steel chimney was completed a year ago; the second would be finished in a month's time. After a conference in 1903 with the Income-Tax Commissioners their secretary succeeded in obtaining an allowance for depreciation on certain items such as cars, cables, overhead lines and machinery, but no allowance could then be got in respect of wear and tear of track. They now had a letter from the surveyor of income-tax acknowledging the company's right to be refunded £8,150. The appeals were initiated and conducted by Mr. Tresilian, the secretary, and there had been no law costs in connection therewith. They would probably shortly be issuing 5,000 or 6,000 of the new shares authorised last year.

The report was adopted after some discussion.

Crossley Brothers, Ltd.

The report of the directors, to be presented at the annual general meeting on February 25th for the year 1909, shows an improvement in the trade of all departments as compared with the previous year. The amount at the disposal of the directors is £101,837 6s. 3d., out of which a dividend has been paid on the preference shares at the rate of 5 per cent. per annum, and a dividend on the ordinary shares at the rate of 4 per cent. per annum to June 30th, 1909, amounting to £21,490 19s.; leaving the sum of £80,346 7s. 3d. for present disposal. Out of this the directors propose to pay a further dividend for the second half of the year at the rate of 5 per cent. per annum on the preference shares, and 5 per cent. per annum on the ordinary shares (making 4½ per cent. for the year), leaving a balance of £56,003 17s. 3d. out of which it is proposed to place £20,000 to the reserve fund, to write off £3,385 17s. 2d. from investments account (reducing them to the present market value), and to carry forward the balance of £32,618 0s. 1d. to next account.

National Telephone Co., Ltd.

The report of the directors for the half-year ending December 31st, 1909, to be presented to the proprietors at the forty-fifth ordinary general meeting of the company on February 24th, shows that the income accrued in respect of the business of the half-year amounts to £1,599,990, as compared with £1,498,432 for the corresponding period of 1908, being an increase of £101,558. The working expenses for the half-year amount to £922,693, as compared with £858,566 for the corresponding period of 1908, being an increase of £64,126. The net result for the half-year (after deducting the Post Office royalties amounting to £153,857) is a profit balance of £523,441, as compared with £495,638 for the corresponding period of 1908, being an increase of £27,802. The rentals carried forward for unexpired terms of running contracts amount to £1,324,916, as compared with £1,245,351 at the corresponding period of 1908, being an increase of £79,565. Out of the available balance of £400,433 shown by the net revenue account (No. 3), the board will recommend the payment for the half-year of a dividend at the rate of 6 per cent. per annum on the first and second preference shares, 5 per cent. per annum on the third preference shares, 6 per cent. per annum on the preferred stock, and 6 per cent. per annum on the deferred stock, less income-tax in all cases. The board also propose to transfer £170,000 to the reserve fund account, and to carry forward the balance of £11,683. The sum of £255,361 has been expended on capital account during the half-year in the erection of 13,896 additional exchange and private stations and in the construction of underground works.

Metropolitan District Railway Co.

Sir George Gibb presided at the half-yearly meeting held at Westminster on February 9th. He said that the results were favourable, and were encouraging for the future. After referring to the figures as to passenger earnings, &c. (see report in Electrical Review, February 11th, 1910), he alluded to the question of reserve for renewals, saying that now they were able to provide for the depreciation which was occurring in their stock, it was their duty to make proper reserve. £20,000 per annum was not any too much. He would like to see it rather more. After mentioning the arrangements made with other railway companies, Sir George described in some detail the scheme that had been prepared for dealing with arrears of interest on the guaranteed stock.

Lord Gorge Hamilton seconded the adoption of the report.

At subsequent meetings the scheme for capitalising the arrears of dividend named above was approved.

German Capital in South America.—The German Transmarine Electricity Co., which is principally engaged in the operation of electric light works at Buenos Ayres, and is interested in tramways and electricity works at Santiago, Valparaiso, and Monte Video, shows no signs of bringing its capital investments to a conclusion, inasmuch as a further issue of shares is now being made. Formed in 1898 with a share capital of £500,000, the company issued additional shares of £300,000 in 1901, £300,000 in 1904, £700,000 in 1905, £1,800,000 in 1906, and £400,000 in 1908, and the present emission of £500,000 will bring the ordinary shares up to £4,500,000. In addition, a loan of £750,000 was issued in 1903, one of £750,000 in 1907, £1,250,000 in 1908, and £750,000 in 1909, making the total bonds amount to £3,500,000, whilst the aggregate capital, including the new shares, will now reach £8,000,000. The shares have been taken over by a guarantee syndicate, and will be offered to existing shareholders at the price of 128 per cent. The official communication which announces the emission simply states that the proceeds are required to meet the monetary needs of the company. On the other hand, it was intimated at the last general meeting, when authority to issue £400,000 in shares and £750,000 in bonds was sought, that these emissions would exhaust the then financial programme, and that the money needed in 1910 would be obtained by the sale of the Metropolitan Tramway at Buenos Ayres or by the flotation of bonds or resorting to banking credit. The issue of new shares, it is considered, apparently indicates that it has not been possible to adhere to the financial programme, but having regard to the enormous capital augmentations which have been carried through, it is suggested that the undertaking now requires a period of quiet development, although there is no statement that the new emission will close the company's capital account.

Rosario.—The Rosario Electric Co., Ltd., in a circular to shareholders, of the 13th inst., states that the board has signed an agreement with the Société Financière de Transports et d'Entreprises Industrielles, of Brussels, under which the Brussels Co. had an option up to July 1st next of acquiring the company's concession, assets and undertaking, in consideration of £518,000, the Brussels Co. taking over the liabilities of the company. In the event of the purchasers desiring to keep the present company alive, the Brussels Co. undertake, as an alternative, to offer to purchase the holdings of individual shareholders (provided that holders of not less than 80 per cent. of each class concur) on the following terms—namely, £6 10s. for each first preference share, £9 for each second preference share, and £9 for each fully-paid ordinary share, and a premium of £4 in addition to the amounts paid up on each partly-paid ordinary share. If this alternative is not acted on, the purchase price of £518,000 will, subject to the approval of meetings of the preference and ordinary shareholders, be distributed on a similar basis. Meetings of the shareholders will be called at an early date to consider the agreement.

British Aluminium Co., Ltd.

On Friday a meeting of the holders of the 5 per cent. mortgage debenture stock of the above company was held at Winchester House, Old Broad Street, E.C., under the provision of the deed of July 28th, 1908, to consider the compromise or arrangement with the company. Mr. W. Capel-Slaughter presided.

The particulars of the scheme are as follows:—The present capitalisation of the company is £200,500 6 per cent. "A" cumulative preference shares, £495,350 7 per cent. cumulative preference shares and £495,350 ordinary shares. There are also issued and outstanding funding certificates amounting to £64,405, of which certificates for £33,440 are held as security. The outstanding debentures and debenture stock are £875,600 5 per cent. first mortgage debenture stock and £124,400 5½ per cent. Loch Leven debentures. The liabilities of the old company and the Receiver are (1) £237,861 borrowed by the Receiver, (2) £210,000 other liabilities, secured and unsecured, on December 31st, and (3) £235,000 as provision for liabilities incurred by subsidiary company, &c. It is proposed to form a new company to take over all the property and effects of the new company, and to discharge all liabilities. The share capital of the new company is to be £300,000 6 per cent. non-cumulative preference shares and £700,000 ordinary shares, total £1,000,000. The debenture stocks are to be:—

Five per cent. prior lien debenture stock not exceeding in amount £1,000,000, carrying interest at the rate of 5 per cent. per annum, and redeemable by means of a prior lien debenture stock service fund of 6 per cent. per annum on the amount of stock issued to be set aside in each year, commencing with the year 1913, and to be applied in payment of interest and subject, thereto, in redemption of the stock by drawings at 105 per cent. and accrued interest, or by purchase in the market under that price. Of this stock only £800,000 will be issued in the first instance. Debenture stock to the amount of £750,000, carrying accumulative interest payable only out of profits at the rate of 5 per cent. per annum (to be increased as after mentioned) as from August 1st, 1910. Out of the profits of each year remaining after providing for the prior lien debenture stock service fund, a debenture stock service fund to be provided of 6 per cent. on the amount of stock issued (such service fund for the year 1910 being 3 per cent.) to be applied in payment of interest and subject, thereto, for the redemption of the stock by drawings at 110 per cent., or by purchase in the market or by tender under that price. When in the course of redemption of the stock the service fund becomes sufficient to provide 1 per cent. on the amount of issued stock for redemption purposes in each year, and to pay an additional ½ per cent. interest on the stock outstanding, the interest to be raised to 5½ per cent. per annum; total £1,750,000. The prior lien debenture stock to be secured as a first specific charge on the land and buildings (including leaseholds) of the new company, and on the share capital amounting to £750,000 of the Loch Leven Water and Electric Power Co., and on a mortgage for £240,000 to be created by that company on its undertaking, and by a first floating charge upon all other assets of the new company for the time being. It may be found desirable hereafter to transfer the property of the Loch Leven Water and Electric Power Co. to the new company, in which case the security of the prior lien debenture stock would cover such property in lieu of the shares and the mortgage referred to. The debenture stock to be secured as a second floating charge on the assets of the new company for the time being.

The appropriation of debenture stock of new company is to be as follows:—(1) £800,000 of the prior lien debenture stock to be issued to subscribers for cash. (2) Every holder of 5 per cent. mortgage debenture stock of the old company (with the exception of the £205,462 held as security for loans) to be entitled to debenture stock of the new company of the same nominal amount. The amount required for this purpose is £670,138; and a further amount of debenture stock equivalent to 1½ years' interest on the 5 per cent. mortgage debenture stock held requiring £50,260; the balance of the new debenture stock to be at the disposal of the new company, £29,602, total £750,000. The interest on the new debenture stock to be issued to run as from August 1st, 1910.

The appropriation of shares of new company is to be:—(1) Every holder of 6 per cent. "A" cumulative preference shares of the old company to be entitled to an allotment of five 6 per cent. non-cumulative preference shares in the new company of £1 each with 17s. 6d. per share credited as paid for every fully paid £5 "A" 6 per cent. cumulative preference share in the old company held by him; (2) Every holder of 7 per cent. cumulative preference shares of the old company to be entitled to an allotment of one 6 per cent. non-cumulative preference share of £1 with 16s. 3d. credited as paid and three ordinary shares of £1 each in the new company with 16s. 3d. per share credited as paid for each £5 7 per cent cumulative preference share in the old company held by him; (3) Every holder of ordinary shares of £5 each of the old company to be entitled to an allotment of three ordinary shares in the new company of £1 each with 13s. 4d. per share credited as paid for each £5 ordinary share in the old company held by him; (4) Every holder of funding certificates to be entitled to an allotment of one fully paid ordinary share of £1 in the new company for each £5 certificate of the old company held by him; (5) Every holder of shares in the old company not fully paid to remain liable to the liquidator for the amount unpaid on his shares; (6) Any partly paid shares of the new company not applied for by shareholders of the old company entitled thereto by their duly constituted nominees within one calendar month of the scheme becoming binding or such extended period as the liquidator may from time to time fix to be sold by the liquidator at such times and in such manner and at such prices as he may think fit. The aggregate proceeds of shares so sold after deduction of expenses of the sale to be divided among the shareholders of the old company entitled to have applied for them in proportion to their respective rights regard being had to the classes of shares sold and the amount credited as paid thereon.

The new company is to pay off (1) the loans of the receiver and manager amounting to £237,861 together with interest at 5 per cent. to the date of repayment and any other liabilities incurred by him; (2) to take over or make provision for the liabilities incurred by subsidiary companies including advances obtained by the Marigny-Orsières Railway Co. (part of which include sums guaranteed by the Receiver amounting at December 31st, 1909, to £2,600) and for the completion of the railway and the Kinlochleven and other works. The total amount required is approximately £235,000. (3) To give such notices as may be necessary to entitle it or him to redeem the Loch Leven debentures (those for £12,300 held as security for loans as above mentioned being cancelled upon making the payments referred to in Clause (4) of this section). The new company to provide all principal money required for such redemption including interest and for that purpose to set aside out of the proceeds of the prior lien debenture stock the sum of £117,000 or thereabouts; (4) The new company also to undertake the other liabilities of the old company (estimated to have amounted at December 31st, 1909, to approximately £310,000) together with interest to the dates of repayment of such claims as carry interest.

The Chairman, having referred to the circumstances which led up to the appointment of a receiver, called on Mr. A. W. Tait, the receiver and manager.

Mr. Tait dealt with the steps which were taken to make an arrangement with the debenture-holders, and which were unsuccessful owing to the state of the money market, and led on June 29th, 1909, to the appointment of a receiver and manager for the protection of the property and assets of the company. Proceeding to explain the scheme of reconstruction, Mr. Tait said they would observe that the borrowing powers exercised by the receiver amounted to £237,861. Immediately after his appointment he made an examination of the company's affairs to ascertain the extent of its requirements, to pay for work done, and to complete the schemes in which the company was engaged. The greater part of the money required was for the completion of the works at Kinlochleven, works including the extension of the housing accommodation for the workmen and also for the extension of some other works of the company in order that the whole of the factories might efficiently work to the full capacity. It also provided for the completion of the Martigny-Orsières Railway and for additional working capital to enable the company to deal with its expanding business. The Kinlochleven works cost more than was originally anticipated. This was not due to any wasteful expenditure of capital but to the large extension of the scheme beyond the original programme. The water-power development which had been already carried out by the company was of a very important character, and the total expenditure when completed would be approximately £1,200,000. The company commenced the manufacture of aluminium at these works in February, 1909, and the works were complete with the exception of a few details. A considerable portion of the expenditure yet to be paid for was in respect of final certificates and retention money on contracts. In addition to the development of the water-power, &c., the company had spent substantial sums on the development of a village for the workmen, and this would be revenue-producing. The other aluminium works at Foyers were in full working order and completely equipped, and no further capital expenditure was contemplated. The alumina works at Larne were in full working, and provision was made in the scheme for their extension. The rolling mills at Milton might also require some development to cope with the development of trade in manufactured and semi-manufactured material, and provision had been made for this. With regard to their interests abroad the total amount of estimated expenditure to complete the Martigny to Orsières Electric Railway was provided for under the scheme. This railway was 12 miles long, and, in addition to local and tourist traffic, it was expected that a considerable revenue would accrue from the carriage of materials to and from the works it was proposed to erect at Orsières. The construction of the line was well advanced, and May 1st was the date fixed for the opening. Mr. Sawyer had recently visited the works, and his opinion was that they should be opened by that time. The total cost of the line when complete would be £215,000. With regard to the Orsières power scheme, upon which the company had spent £160,000, it was not proposed at this stage to proceed further with the completion of the works, and arrangements had been made whereby they would be properly looked after for three years, during which time the new board of the company could decide whether they should proceed with the completion of the scheme, make arrangements for others to join them in the development, or dispose of their interest. According to the engineers it seemed probable that large water-power could be developed at the lowest possible cost, and should it be decided to proceed with this, provision had been made in the capital. As the result of their work for 1909, the company had made a profit. The complete figures were not yet available, but it was a matter of no small satisfaction during a period of transition when constructive work was going on and the Loch Leven Works were only turning out a part of the output of which they were capable, and during a period when the alumina industry had been upset, to know that the company carried on its business at a profit. During 1906 7 the company made abnormal profits on a small output, owing to the high price which the material reached, and they would appreciate that when the fall occurred it was very severe. The fall was due, first, to the collapse of the price of copper, and, secondly, to the breaking up of the association which had previously existed for regulating the price of aluminium. During 18 months the price fell from £200 a ton to well under £60, and it was an encouraging fact that profits were made in 1907-8 whilst the selling price of the metal was less than £60 a ton. The fall in price had, however, its compensation in the extension which had taken place in the demand for the metal, and whilst they sold 1,618 tons in 1907 and 1,467 tons in 1908, they sold 4,773 tons in 1909. Whereas the company started 1909 with a surplus stock of metal of approximately 1,500 tons; at the end of the year all that surplus stock had been disposed of, and thus the company started this year with a clean slate, and there was every prospect that they would sell a substantial quantity of metal. He believed they would sell 5,000 tons of metal, all of which could be manufactured at the company's works during the year. The profits which could be made were dependent on three factors, viz.: (1) output; (2) price of metal; and (3) cost of production. The company's works would in the course of the year be equipped to turn out a large quantity of metal, and with certain improvements in the process of manufacture which were going on, it was believed the output could be further increased. The price was dependent on the relation between demand and supply, and there was no doubt that the consumption was extending now that the former artificial high price had been broken down. With returning better trade conditions which seemed to be probable in the next year or two there were reasonable expectations that prices would reach £80 a ton. For the last six months negotiations had been carried on with a view to the re-formation of the association which previously existed, but owing to the inability of various manufacturers to see eye to eye with regard to the proportion of trade to which they considered they were entitled, the negotiations were not successful. There were, however, indications that the severe competition which formerly existed was being alleviated, and prices had recovered materially from the lowest touched in the early part of last year. He did not think it should be the policy of the company to restrict

the supply to any material extent to obtain increased prices. The demand was growing in a satisfactory manner, and would continue to grow as long as prices were maintained at a reasonable level. This policy would also prevent any increase in the competition, because the prices, while offering a fair profit, were no inducement to outside parties to expend the large sums necessary to enter the business. As to the cost of production, he believed that of the company was as low as that of any of its competitors. This was a matter on which it was difficult to obtain accurate information, but, owing to the improvements in the process and the situation and capacity of the works, he should be inclined to say this was an under-statement of the truth. He thought, therefore, that with a return to normal conditions the company should be able not only to earn the interest on the debenture stock, but also to pay regular dividends on its preference and ordinary shares.

MR. RUHE seconded the motion.

Considerable discussion ensued, in which MR. MULLINS said he would strongly object to any of the old directors being on the new board.

MR. R. W. COOPER said he was one of two of the old directors who were going on the board, but he was only appointed on the old board in April as the representative of some very large interests.

MR. MULLINS characterised the old board as being incompetent, and pointed out that inflated dividends had been paid on all classes of shares. The directors must have known that the dividends were obtained by the sale of the metal at purely fictitious prices, but on the strength of the big dividends the public were asked to take 6 per cent. preference shares, and he considered they had been most disgracefully misled.

MR. COOPER said he had nothing to do with the issue of the new capital.

MR. GARNETT MANN, MR. W. CURRIE and MR. BISHOP SMITH complained of the way in which they had been led to exchange their debentures in the Loch Leven Co. for those of the British Aluminium.

MR. M. CURRIE and MR. ABBOTT considered that, whilst the scheme was all right for debenture-holders who were also shareholders, yet debenture-holders simply ought to be dealt with on the terms of the prospectus on which they subscribed.

MR. TAIT, in reply to these and other questions, said the remuneration of the new directors had not been fixed, but it would probably be settled on the basis of a percentage of the profits earned. Mr. Cooper had nothing to do with the policy of the old board. Mr. Sawyer, the other old director, had been asked to join the new board because of his intimate knowledge of the foreign business. He took it that the policy of the old board with regard to the Loch Leven debentures was part of their policy for the consolidation of the debentures of the whole concern. He said that the assets of the company represented an expenditure of £2,500,000, and he knew that figure was correct. Undoubtedly, the only alternative to the scheme was foreclosure, and if the debenture-holders did this, they would, in order to obtain any value for themselves, have to put up the money required under the scheme in order to operate the company as a going concern, and therefore, instead of getting the shareholders to assist with £200,000, they would have to find all the money themselves. He considered the scheme a fair and equitable one for all parties concerned.

On the motion being put, it was carried with five dissentients. MR. MULLINS appealed to the dissentients to withdraw their opposition and save further expense, and the CHAIRMAN said that proxies to the value of £691,000 had been lodged with the board.

The motion was then put a second time and carried without dissent.

Following the debenture meeting there was an extraordinary general meeting of the shareholders held in the Great Hall, presided over by Mr. Tait, when there was a large attendance of shareholders.

The CHAIRMAN, having delivered the same speech as at the debenture-holders' meeting, proposed a resolution approving of the scheme.

MR. R. W. COOPER seconded.

MR. MCIVER moved: "That the proposed scheme be not agreed to until a full investigation of the company's affairs has been made by a committee of shareholders." He said it would be difficult to find a parallel in the management of companies to this one. The scheme wrote off as an absolute loss the sum of £500,000, and called on them for £200,000, and it was almost a scheme of blackmailing. In 1906 £700,000 of capital was issued, and in 1908-9 half a million more, and within six months of the large issue, they found themselves in this position.

MR. COLE asked what net profits would have to be made before the company could pay anything to the ordinary shareholders.

MR. RIDSDALE did not think the shareholders had sufficient facts on which to form a judgment of the position of affairs. It was a very drastic scheme, but he did not want to oppose it. He would like, however, to know whose scheme it was.

MR. PRITCHARD, MR. BOLTON and MR. PAGE having spoken,

The CHAIRMAN said that if the shareholders did not agree to the scheme the debenture-holders would foreclose, and the shareholders would be wiped out. It would mean a profit of about £150,000 a year to pay 6 per cent. on the ordinary shares. The scheme was the outcome of lengthy discussion between all classes of people largely interested. The capital subscribed had all gone into the assets of the company. With regard to the agreement made about not supplying from Orsières, that came to an end in 1913. If the scheme was carried they would start with a clean slate, and after dealing with depreciation and reserve, apply the profits to dividend purposes. There would be no balance-sheet for 1908, but the next balance-sheet would be that of the new company.

The amendment of Mr. McIver having been ruled out of order, MR. RIDSDALE proposed that committees of the various classes of shareholders be appointed to consult with the Receiver in the preparation of a scheme and the appointment of a new board.

This was seconded by MR. MCIVER, but defeated by a large majority, and the resolution was then adopted.

Meetings of four other classes of shareholders were next held, and the resolution approving of the scheme was agreed to.

Tyneside Tramways and Tramroads Co.

THE directors' report for the half-year ending December 31st, 1909, states that the surplus of receipts over expenses is £2,979, which, with the balance brought forward from last half-year of £773, makes a total to the credit of profit and loss account of £3,752, and after deducting interest on debentures, loans, &c., amounting to £1,036, there remains an available balance of £2,716. This profit the directors propose to appropriate as follows:—A dividend on the preference shares at the rate of 5 per cent. per annum (less income-tax), absorbing £590; a dividend on the ordinary shares at the rate of 1½ per cent. per annum (less income-tax), as compared with 1½ per cent. for the corresponding half-year of 1908, absorbing £1,004; to credit of reserve for renewals, depreciation, and other contingencies (increasing it to £7,600), £600; leaving £521 to be carried forward. The dividend paid on the ordinary shares for the whole year is ½ per cent. better than for the year 1908. The weekly increase of receipts, as compared with 1908, was satisfactory during the first half of the year, but gradually slackened off until, during the closing weeks of the year, a decrease was recorded. The trade of the district served now shows signs of improvement which should react favourably on the company's results. The whole of the track, overhead line and rolling stock has been kept in thorough repair during the past year out of revenue. Of the unissued preference shares 60 were applied for and allotted during the half-year, leaving 596 still unissued. The following is a comparative statement:—

	1907.	1908.	1909.
Car-miles (Tyneside Tramway Co.'s cars) ..	679,692	675,394	687,719
Passengers carried (Tyneside Tramway Co.'s lines)	4,703,459	4,143,625	4,375,866
Total traffic receipts	£24,068	£21,930	£22,947
Gross profit	8,262	6,447	6,725

At the meeting held at Newcastle-on-Tyne on February 8th, the CHAIRMAN (Mr. J. T. MEIZ), in moving the adoption of the above report, said that the traffic receipts for the year showed an increase of £1,017, of which £100 was attributed to the increase of holiday traffic. For the first half-year the increase was £748, and for the second half-year it was £269, so that the improvements shown in the first half-year had not been maintained in the second half. The mileage run was 687,719 miles, that being the maximum run in the history of the company, and 12,325 more than the previous year. Of that increase 9,000 miles was due to workmen's cars. The revenue per car-mile was 8·01d., as against 7·79d. in the year before, and 8·49d. in 1907. The number of passengers was 4,375,866, an increase of 232,241 on the previous year, and of these 145,000 were workmen. For 1907 the directors had to report a decrease of 559,000 in the number of passengers carried. The expenses last year had been a little more than in 1908—the increased amount being £591—or 5·87d. per car-mile, as against 5·77d. per car-mile. That increase was owing to the gradual wear and tear, and small replacements and renewals which were necessary upon the whole system, on the cars, the tracks and trolley wires. That increase would go on as long as they did not charge those repairs or renewals to the reserve fund, which up to now was intact and untouched. If they continued their present policy it was not anticipated that they would have to entrench upon their reserve fund for a good many years to come—not until the reserve fund had been increased to a considerable amount. The profit during the year was slightly more than in the previous year. It was £6,724, and that was an increase over the year before of £278. Out of that profit, they had placed to reserve £1,500, thereby increasing the reserve fund to £7,600. They had also written £3,300 off their preliminary expenses. They had placed 151 of their preference shares, leaving 596 preference shares, representing capital to the amount of £5,960. Their indebtedness had been reduced from £6,000 to £3,200, and if they continued wiping off at the same rate they would presumably be free of debt at the end of next year. It would probably have been noticed that during January of this year there had been a considerable falling-off in receipts; he did not know whether it would be any consolation to them to know that a similar falling-off had been experienced in other concerns dealing with traffic in the district, but it indicated that there were various causes for the falling-off.

The report and its recommendations were approved.

Mather & Platt, Ltd.—The *Financial Times* says that the report of the directors for the year ended December last, to be presented at the annual meeting in Manchester on 23rd inst., states that the net profits, after charging depreciation and directors' remuneration, amount to £106,367, and £30,512 was brought forward. The directors recommend a final dividend at the rate of 10 per cent. on the old ordinary shares, making 10 per cent. for the year, and at the rate of 10 per cent. per annum on the new ordinary shares, which were issued in December last, as a bonus, out of the reserve fund. The directors also recommend a bonus of 2 per cent. on the ordinary shares, old and new, placing £25,000 to the reserve fund, making this £200,000, and carrying forward £19,879.

Bruce Peebles & Co., Ltd., Engineers, Edinburgh.

The annual report of the directors, which is being presented at the first annual general meeting at East Pilton, Edinburgh, to-day, gives a statement for the period from December 5th, 1908 (the date of incorporation), to December 31st, 1909. The debenture and share capital has been issued in accordance with the scheme of reconstruction, as follows: To the debenture-holders—5 per cent. debentures, £75,000; to the creditors—unsecured debentures, £45,809; 76,450 preference shares at £1 each, fully paid, £76,450 = £122,259; to the shareholders—43,301 preference shares at £1 each, 13s. 4d. paid, £32,201; 3,256 ordinary shares of £1 each, 10s. paid, £1,628 = £33,829, £231,088. The trading for the period, after deducting maintenance, general charges and expenses of administration, shows a loss of £5,683, to which has to be added the interest on the first and second debentures, less interest received, increasing the balance to £12,981. Although the company was registered on December 5th, 1908, it was not until towards the end of January, 1909, that the directors were able to secure the services of Mr. Lee Murray as general manager, and to actively prosecute the business of the company. The past year has been one of extreme difficulty and acute competition, both with home and foreign manufacturers. The directors and general manager have given constant attention to the business in order to obtain and deal with future work. They consider that great progress has already been made. Endeavours have been made to obtain licences to construct and develop new manufactures, and certain arrangements have been completed which it is anticipated will materialise in the near future. It was considered desirable to have a complete valuation of the buildings, plant, machinery and tools of the company made by an independent firm. The figures in the balance-sheet are the result of such valuation. The stock, stores, &c., have also been valued on a conservative basis. The buildings, machinery and plant have been maintained in good condition during the year. Great progress has been made during the period in the satisfactory settlement of contracts left uncompleted by the old company. The retiring directors are Mr. F. E. Andrews and Mr. C. H. M'Euen, who, being eligible, offer themselves for re-election. Mr. M. B. Mountain retired from the board at the end of December last. The directors elected Mr. A. B. Anderson, Manchester, to fill the vacancy, and Mr. Anderson offers himself for re-election.

Rees Roturbo Manufacturing Co., Ltd.

At the annual meeting held in Wolverhampton on Thursday last week, the report presented showed a profit on the year's working of £8,000, enabling a dividend of 5 per cent., free of income-tax, to be declared.

Mr. J. G. Underhill, who presided, compared the results with the estimates given in the prospectus, and said there was every indication that the estimate was an accurate one. With regard to the design generally, each month confirmed the high opinion the directors formed of the patents under which they worked. The only practical test of the advantages of a patent was the account it gave of itself as a saleable article after working trials. He thought the best example that could be given of this test was the history of the Roturbo in the South African market. In a market of this description, competed for fiercely by British, German and American manufacturers, it was difficult to get a footing, and in the early days of the patent they experienced this difficulty; in fact, the first Roturbo was sent to agents in South Africa in September, 1908, and it was impossible to get any further orders until this had justified itself. The fact that at the present time over 70 pumps had been ordered from South Africa, and that they were getting an increasing trade in this market month by month, was, in the board's opinion, a conclusive argument of the advantages which the Roturbo offered over its competitors, which had such a good start. The history of the South African market duplicated the experience of the company in India, where the export business in Roturbos was first commenced. In fact, it was to meet the difficulties of the Indian conditions that the Roturbo pump originated. Their Indian agents had absorbed large numbers of the smaller pumps, and most satisfactory orders had been received from the India Office, for irrigation and other work, where there would be very little chance of being considered unless they could show improvements on the types of pumps which they had been buying in the past. Markets were also being opened up in China and Japan, which would, no doubt, bear fruit rapidly. The shareholders would notice in the shops a large pile of packing cases ready for shipment, which only awaited delivery instructions. This was a large order for a complete sugar refinery plant on the Continent, and the fact of being able to send machinery against Continental competition showed that they must have something which gave them an advantage. This order was for 38 pumps, and was only booked last September. The pumps were of the latest designs. Referring to the home trade, the chairman said they had every reason to be satisfied with the progress made. The British Admiralty was, perhaps, the most difficult field to enter, and with regard to this they had supplied a large number of pumps for special departments of the Admiralty through private firms, and had executed an order direct from the Admiralty for eight comparatively small motor-driven pumps for their latest battleships. Each individual pump on this order was tested under very drastic conditions in their works by the Admiralty officials before dispatch, and proved satisfactory in every way. In conclusion, the chairman said that the directors looked forward with confidence to the future of the company.

Mr. J. Howard Kemp seconded the motion, and it was carried.

A dividend of 5 per cent. was then declared.

Rees Roturbo Development Syndicate, Ltd.

—The third annual meeting was held at Wolverhampton on Thursday last week. Mr. J. E. Underhill, who moved the adoption of the report (see Electrical Review last week), said that the syndicate was in about as good a position as they could possibly hope for. The shareholders would notice from the accounts that they were carrying forward a large balance. The reason of this was because in the natural order of things the life of the syndicate was limited to 14 years, and although new patents were being taken out which would probably lengthen this, it was good policy to cover their capital. He then proposed that a dividend at the rate of 6 per cent. for the past half-year be declared. This, having been seconded, was unanimously agreed to.

Baker Street and Waterloo Railway Co.

The directors' report for the half-year ending December 31st, 1909, states that the gross receipts on revenue account amounted to £88,578, being an increase of £2,223 on the receipts for the corresponding half of last year. The working expenses amounted to £42,644, being a decrease of £2,019. After providing for interest, rents and preference dividend, and reserving £2,000 for contingencies and renewals, there remains a balance of £18,166 available for ordinary dividend, and the directors recommend that a dividend at the rate of 1½ per cent. per annum be declared on the ordinary shares, and an additional dividend at the rate of 1½ per cent. per annum (making 3 per cent. per annum in all) on the ordinary shares other than those held by the Underground Electric Railways Co. of London, Ltd., or their nominees, leaving a balance of £2,720 to be carried to next half-year's account. The dividends will be payable on February 19th. The obligation of the Underground Co. to guarantee the payment of dividend at the rate of 3 per cent. per annum on the ordinary shares of the company ceased on the abandonment of the Paddington extension in August last, but the Underground Co. have agreed to the dividend at the above rate being continued for the past half-year on the ordinary shares other than those held by the Underground Co. or their nominees. The following table gives a summary of the working expenditure in comparison with the corresponding period of last year:—

	Half-year Dec., 1909.	Half-year Dec., 1908.	Inc. or dec.
Maintenance of way and works, &c. ..	£2,450	£4,230	—£1,780
Repairs and renewals of rolling stock ..	3,089	4,123	— 1,054
Lift expenses	4,113	4,440	— 327
Train working and traffic expenses ..	24,537	24,801	— 264
Other items	4,074	2,720	+ 1,354
	£38,243	£40,314	—£2,071
Rates and taxes	4,401	4,349	+ 52
Total	£42,644	£44,663	—£2,019

The following table gives a summary of comparative statistics for the second halves of the years 1908 and 1909:—

	Half-year Dec., 1909.	Half-year Dec., 1908.	Inc. or dec.	Per cent.
Passengers, including workmen and season ticket holders' journeys	13,920,021	13,337,126	+582,895	+4·37
Passengers at workmen's fares ..	1,884,137	1,782,644	+101,493	+5·69
Passenger receipts	£84,288	£82,493	+ £1,795	+2·18
Average receipt per passenger ..	1·45d.	1·48d.	— ·03d.	—2·03
Train-mileage	632,743	594,381	+ 38,362	+6·45
Car-mileage	1,907,496	1,819,239	+ 88,257	+4·85

The increase of traffic at Oxford Circus Station renders it necessary to enlarge that station. Powers for a scheme of enlargement were contained in the Bill promoted by the company in the last Session of Parliament, which was withdrawn under the circumstances referred to in the last half-yearly report of the directors, and a Bill has now been deposited in Parliament seeking authority, amongst other things, to carry out the requisite enlargement of the station either by the purchase of additional property adjoining the station or by providing a new station, jointly with the Central London Railway Co., on the northern side of Oxford Street. This latter proposal, however, will only be proceeded with if it is found possible to arrange satisfactory terms with the Central London Railway Co. and the owners of the principal property which would be affected by the scheme. The Bill will be submitted to the shareholders for approval.

A Bill has been deposited in Parliament by the Charing Cross, Euston and Hampstead Railway Co., seeking power to extend that company's railway from its present terminus at Charing Cross to a point under the Charing Cross Station of the Metropolitan District Railway Co., and to make agreements with this company and the District Co. with reference to the construction, working, maintenance and user of the proposed railway, and of any station or works connected therewith. It is intended to provide direct connection by lifts between the proposed station and the existing stations of this company and the District Co. The existing long and steep subway forming the approach to this company's station will be abolished, and the interchange between the three companies will be greatly improved. The cost of the proposed railway and works is estimated at £303,000. An agreement will be made providing for annual payments to the Hampstead Co. by this company and the District Co. on the basis of the benefit which each company will derive from the exchange of through traffic. This Bill will be submitted to the shareholders for approval.

A Bill seeking powers for the amalgamation of this company and the Charing Cross, Euston and Hampstead Railway Co. with the Great Northern, Piccadilly and Brompton Railway Co., has been deposited in Parliament, and will be submitted for the approval of the shareholders.

Yorkshire Electric Power Co.—The report presented at the meeting at Leeds on Tuesday shows satisfactory progress. The receipts for energy and work charged for the past 12 months amount to £25,762, against £18,643 for 1908 and £11,894 for 1907. The net revenue account shows a profit of £2,664 on the year, as compared with £717 of 1908, and a loss of £1,350 for 1907. It is proposed to carry forward a total disposable balance of £3,382. The company is carrying forward as an asset £13,284 in respect of administration and development expenses, and until this is wiped out shareholders cannot expect any return.

Great Northern, Piccadilly and Brompton Railway Co.

THE directors' report for the half-year ending December 31st, 1909, shows that the gross receipts on revenue account amounted to £152,340, being an increase of £9,106 on the receipts for the corresponding half of last year. The working expenses amounted to £70,142, being a decrease of £2,326. After providing for interest, rents, and preference dividend, and reserving £3,000 for contingencies and renewals, there remains a balance of £37,574 available for ordinary dividend, and the directors recommend that a dividend at the rate of 1½ per cent. per annum be declared on the ordinary shares, leaving a balance of £6,024 to be carried forward. The dividends will be payable on February 19th. The following table gives a summary of the working expenditure in comparison with the corresponding period of last year:—

	Half-year ending Dec., 1909.	Dec., 1908.	Inc. or dec.
Maintenance of way and works, &c.	£4,879	£6,391	—£1,512
Repairs and renewals of rolling stock ..	4,245	4,089	+ 156
Lift expenses	6,751	7,069	— 318
Train working and traffic expenses	42,412	42,411	+ 1
Other items	4,499	4,840	— 341
	£62,786	£64,800	—£2,014
Rates and taxes	7,356	7,669	— 313
Total	£70,142	£72,469	—£2,327

The following table gives a summary of comparative statistics for the second halves of the years 1908 and 1909:—

	Half-year ending Dec., 1909.	Dec., 1908.	Inc. or dec.	Per cent.
Passengers, including workmen and season ticket holders' journeys	18,338,812	16,990,501	+ 1,348,341	+ 7·94
Passengers carried at workmen's fares	2,471,669	1,994,342	+ 477,327	+ 23·93
Passenger receipts	£144,535	£137,255	+ £7,280	+ 5·30
Average receipt per passenger,.	1·89d.	1·94d.	— ·05d.	— 2·58
Train-mileage	1,217,031	1,147,383	+ 69,648	+ 6·07
Car-mileage..	3,745,823	3,565,838	+ 179,985	+ 5·05

A Bill seeking powers for the amalgamation of this company with the Baker Street and Waterloo Railway Co. and the Charing Cross, Euston and Hampstead Railway Co. has been deposited in Parliament, and will be submitted for approval.

Liverpool Overhead Railway Co.

THE half-yearly meeting was held at Liverpool on February 8th, Mr. H. C. Woodward presiding, in the absence of Mr. Wm. Forwood.

The CHAIRMAN said that the accounts showed an improvement on the previous half-year. There was a small decrease in the revenue amounting to £380, which was mainly, if not entirely, attributable to the continued depression in trade. On the other hand, the directors pointed with satisfaction to the continued reduction in the working expenses, which had resulted in a saving of £1,345 on the half-year after providing £873 towards the final settlement of claims arising out of the accident at Seaforth Sands Station in December, 1908, still leaving a balance of £500 in their contingent fund. They had also made their usual contribution of £1,500 to the renewal fund, as against £1,000 in the corresponding period. This fund now amounted to £38,732. The structure and rolling stock had been well maintained, and were in good and efficient condition. Compared with the same period in 1908, they now proposed to pay a whole year's interest on the 1909 second preference shares, they had paid £873 in compensation as against £34 only last year, had placed £500 more to the renewal fund, and had a balance to be carried forward to next half-year of £404 more, so that, although they had a slight decrease in the revenue, had it not been that they preferred to continue their policy of keeping up their reserve and contingent accounts in order that when the time came for any special disbursement to be made their company would be in a position to meet them, they would have been able to give them a small dividend on their ordinary shares. In spite of all their efforts at reduction of expenses they were further confronted with an increase in their rates and taxes of £187. In common with all railway undertakings, the Overhead Railway still felt the stress of the severe competition from municipal tramways. Before the first portion of the Liverpool Corporation electric tramways was opened between the City and Dingle in 1898, the company were receiving 1·99d. per passenger. In 1900, when they commenced their service to Seaforth, they were receiving 1·93d. per passenger. Since then they had had additional competition by the Lancashire and Yorkshire electrifying their line between Liverpool and Southport, which again caused them to reduce their fares, and now they only received 1·72d. per passenger. If they had carried last half-year's traffic upon the basis of the fares charged in 1900, they would have received an additional revenue of £3,534. In order to meet the convenience of passengers, and to induce further traffic between the company's tramcars and trains, it had been decided to construct a lift at Seaforth Sands Station; and they were also spending some money on their tramway by placing renewable plates on the rail joints to ensure smoother running and to increase the life of the rails. With a view to further economies they had also installed two new dynamos at their generating station in place of old machines, and had re-equipped two of the trains with modern motors, controllers, &c. Comparing the cost of working per train-mile with similar railways in London, they found that their own expenditure, after deducting the contribution to the renewals fund, was last half-year 11·99d., and the City and South London Railway, which most closely resembled the Overhead line, was 14·10d.; the Central London Railway reached 25·56d. Their locomotive expenses were 3·96d. per train-mile; City and South London Railway, 4·57d.; and the Central London Railway, 5·79d. The traffic expenses worked out at 4·33d., against 6·10d. on the City and South London Railway, and 9·23d. on the Central London Railway. Where they compared unfavourably was in the revenue per train-mile. Whilst they only made 17·15d., the City and South London Railway earned 30·71d., and the Central London Railway 43·40d. The mileage run had decreased 6,659 miles, and there was a total decrease in expenditure of £1,480 in the half-year. The running expenses showed a decrease of £404. Repairs and renewals were £400 less, partly due to less repairs, owing to reduced speed. Every item of expenditure was continually and closely scrutinised, and the directors were satisfied that the success of the line would come from an increased revenue, which might be anticipated when the trade of the port was in a more settled state, and also there should be a considerable increase in revenue should the Dock Board determine to proceed with their proposed new docks at the north end of the city. They were very much pleased with the care and attention given by Mr. E. J. Neachell since his appointment as engineer and manager, and had a high opinion of his mechanical and electrical abilities.

MR. J. L. ANDERSON seconded the motion for the adoption of the report.

The CHAIRMAN, replying to questions, said that at present the suggestion to link up the line at the south end (Dingle Station) with the Cheshire Lines Railway, so as to form, along with the link at the north end (Seaforth Station) with the Lancashire and Yorkshire Railway, a complete belt route, was in abeyance. As far as their own company was concerned, they would be glad to see the scheme carried out, but, unfortunately, they were themselves not prepared, with their limitations of capital, to embark upon it.

The resolution was then carried unanimously.

Westminster Electric Supply Corporation, Ltd.

THE directors' report for the year 1909 states that the supply of current, which on December 31st, 1908, was provided for the equivalent of 31,525 KW., had increased by December 31st, 1909, to the equivalent of 32,567 KW. The length of roadway in which continuous current mains have been laid now exceeds 87 miles, making about 346 miles of ways, into which upwards of 267 miles of copper (strip and cable) have been drawn. In addition 6 miles of trunk mains (35 miles of ways) are laid in the company's area to connect the stations with the Central Electric Supply Co.'s station at St. John's Wood. During the year the directors have created a deposit fund to encourage thrift among their employés, the maximum subscription being 5s. per week. Interest is allowed at half the current rate of ordinary dividend, with a minimum of 4 per cent. per annum, and the fund is, therefore, to some extent a profit-sharing scheme. The balance in the hands of the company at December 31st was £915, and the directors feel sure the scheme will commend itself to all the shareholders. The cash award in the arbitration with the L.C.C. in connection with their acquisition of the company's Millbank Street station under the L.C.C. (Improvements) Act, 1900, was, exclusive of the exchange of site, £184,471, which sum has been applied towards the cost and equipment of the new and larger station in substitution in the Horseferry Road. The capital expenditure on Millbank Street, and the amount paid to the City of Westminster Electrical Syndicate for the lease, &c., have, therefore, been written off as shown in the capital account No. 3. Horseferry station is rapidly approaching completion; the plant and machinery will shortly be in operation. The site of this station is entirely the freehold property of the company. An interim dividend, at the rate of 10 per cent. per annum on the ordinary shares, and the dividend on the 4½ per cent. preference shares for the half-year ending June 30th, 1909, has been distributed. After allowing for depreciation, sinking fund and other charges, the net balance is £55,622, from which must be deducted the second half-year's dividend on the preference shares, which absorbed £8,610, leaving a balance of £47,012. Out of this the board recommend the payment of a dividend at the rate of 10 per cent. per annum, less income-tax, for the past half-year, carrying forward a balance of £21,116. The following is a statement of electricity sold, &c.:—

Quantity utilised—Sold to consumers	18,546,815
Used on works	239,174
Total	18,785,989
Connections to circuit December 31st, 1909, in KW.	32,567

National Electric Supply Co., Ltd.—At the meeting held on 10th inst. at Fishergate, Preston, dividends of 4 per cent. for the year on the preference shares and 4s. 6d. per share on the ordinary shares for the half-year, making, with the interim dividend paid in July, 7s. 6d. per share for the year, were declared. A dividend of £1 7s. 2d. per share on the founders' shares was declared on the motion of the chairman, Mr. Cuthbert Pyke. In the course of his annual statement, the chairman referred to the company's satisfactory progress, mentioning that during the year about £40,000 had been expended upon the mains, largely owing to an important extension over the dock property to enable the company to accept a large power installation. Although the company had done a slightly larger business than in the previous year, and had obtained a number of new consumers, there was a falling-off in the amount received from the sale of energy, the reason for which the chairman explained. It was proposed to carry £4,400, the same as last year, to reserve for depreciation, and to carry forward the balance of £748.

Provincial Tramways Co.

Mr. Andrew Beattie presided on Friday of last week over an extraordinary general meeting of the above company to consider a number of resolutions dealing with the capital of the company and the articles of association. The principal resolution was as follows:—

That the capital of the company be reduced from £400,000 (divided into 10,000 preference shares of £10 each and 30,000 ordinary shares of £10 each) to £275,440, divided into 10,000 preference shares of £10 each and 24,912 ordinary shares of £5 each, and 5,088 ordinary shares of £10 each, and that such reduction be effected by cancelling paid-up capital which is unrepresented by available assets to the extent of £5 per share on each of 24,912 issued ordinary shares, and by reducing the nominal amount of such 24,912 ordinary shares from £10 to £5 each.

Other resolutions provided for the division of the 24,912 issued ordinary shares into five fully-paid shares of £1 each, and the 5,088 unissued ordinary shares into 10 shares of £1 each. The meeting also considered several alterations in the articles of association.

Mr. J. Barber Glenn, the secretary, stated that proxies representing 85,260 shares had been received in favour of the scheme. Four or five shareholders had written pointing out that they did not agree with specific proposals. As to the article which related to the payment of the directors' travelling expenses, they had about 90 per cent. of their ordinary shareholders in Ireland, and about 60 per cent. of the preference shareholders also resided in the same country.

The Chairman said that this was not the first time proposals had been made for altering the articles of association. About three years ago they considered a scheme, but as the shareholders did not at that time seem to take any great interest in the matter, the board let it drop. Now they brought forward three proposals, and as they had heard, the majority of the shareholders were in favour of them. The directors brought the matter forward at the request of the shareholders, and it was a matter which they left entirely to them. The scheme could injure nobody, and some of the shareholders seemed to think it would benefit the ordinary shares.

Resolutions were then put to the meeting, embodying the proposals, and they were carried.

Charing Cross, Euston and Hampstead Railway Co.

The directors' report for the half-year ending December 31st, 1909, states that the gross receipts on revenue account amounted to £105,139, being an increase of £11,072 on the receipts for the corresponding half of last year. The working expenses amounted to £58,289, being an increase of £1,047. After providing for interest and rents, and reserving £1,500 for contingencies and renewals, there remains a balance of £16,826 available for ordinary dividend, and the directors recommend that a dividend at the rate of ¾ per cent. per annum be declared on the ordinary shares, leaving a balance of £603 to be carried forward. The dividends are payable on February 19th. The following table gives a summary of the working expenditure in comparison with the corresponding period of last year:—

	Half-year ending Dec., 1909.	Dec., 1908.	Increase or decrease.
Maintenance of way and works, &c. ..	£3,807	£5,940	— £2,133
Repairs and renewals of rolling stock ..	3,139	2,753	+ 386
Lift expenses	4,936	5,039	— 103
Train working and traffic expenses ..	38,400	36,406	+ 1,994
Other items	3,317	2,292	+ 955
	£53,529	£52,430	+ 1,099
Rates and taxes	4,760	4,812	— 52
Total	£58,289	£57,242	+ £1,047

The following table gives a summary of comparative statistics for the second halves of the years 1908 and 1909:—

	Half-year ending Dec., 1909.	Dec., 1908.	Inc.	Per cent.
Passengers, including workmen and season ticket journeys	14,524,280	13,015,363	1,508,917	+11·50
Passengers carried at workmen's fares	2,783,600	2,356,819	426,781	+18·11
Passenger receipts	£99,743	£89,717	£10,026	+11·18
Average receipt per passenger	1·65d.	1·65d.	—	—
Train-mileage	1,062,368	818,058	244,310	+29·86
Car-mileage	2,985,398	2,626,055	359,343	+13·68

The directors have been engaged in settling with the Underground Electric Railways Co. of London, Ltd., all outstanding matters arising under the contracts for the construction of the company's railway. The outcome of the settlement is that, subject to the authority of Parliament being obtained for the creation and issue of additional capital for the purpose, this company are to issue to the Underground Co., £400 000 in fully-paid ordinary shares in discharge and liquidation of a balance of account amounting to £242,094 for extra works. The agreement providing for the settlement between the two companies will be submitted to the shareholders for approval at the ordinary meeting.

A Bill has been deposited in Parliament and will be submitted for the approval of the shareholders at the special meeting, to be held after the ordinary meeting, seeking power to extend the company's railway from its present terminus at Charing Cross to a point under the Charing Cross Station of the Metropolitan District Railway Co., and to make agreements with the District Co. and the Baker Street and Waterloo Railway Co. with reference to the construction, working, maintenance and user of the proposed railway and of any station or works connected therewith. It is intended to provide direct connection by lifts between the proposed station and the existing stations of the District and the Baker Street Companies. The interchange between the three companies will thereby be greatly improved and it is expected that this company will obtain a substantial amount of additional through traffic. The cost of the proposed railway and works is estimated at £308,000. An agreement will be made providing for annual payments to this company by the District and the Baker Street Companies on the basis of the benefit which each company will derive from the exchange of through traffic.

The Bill also seeks statutory confirmation of an agreement made with the South-Eastern Railway Co., and the South-Eastern and Chatham Railway Companies' Managing Committee and the District Co., with reference to easements required by the company for the purposes of the proposed railway.

The capital which the Bill will enable the company to raise is £400,000 in ordinary shares or stock, and £200,000 in debentures or debenture stock.

A Bill seeking powers for the amalgamation of this company and the Baker Street and Waterloo Railway Co. with the Great Northern, Piccadilly and Brompton Railway Co. has been deposited in Parliament. A full statement in regard to the scheme of amalgamation accompanies the report.

Lanarkshire Tramways Co.

The directors report for the half-year ended December 31st, 1909, that the revenue has been £36,267, and the expenses £19,767 = £16,500; less contributions payable to local authorities, £824; interest on debentures, £608; amounts written off, as per revenue account, £925; leaving £14,143; plus balance brought forward from June, 1909, £5,283—£19,426. Of this amount, £8,500 has been placed to reserve for depreciation, and the directors now recommend a dividend at the rate of 5½ per cent. per annum for the half-year on the share capital issued prior to January 1st, 1909, requiring £8,470; a dividend at the rate of 5½ per cent. per annum on the issue of 3,500 shares, calculated on £5 per share from July 1st and the balance from due date of the instalments to December 31st, 1909, requiring £894; £234 to directors being 10 per cent. of net profits after payment of 5 per cent. dividend for the year; and £1,329 to revenue new account. The traffic receipts for the half-year show an increase of £2,719 as compared with the receipts for the corresponding half-year of 1908, due to the extensions from Hamilton to Uddingston and from Wishaw and Newmains, opened in July last. The directors anticipate that, with an improvement in trade conditions, the receipts will be more satisfactory. The capital expenditure during the half-year was mainly on the Uddingston and Newmains extensions and an additional bay at the car-shed.

Half-year ended.	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
June 30th, 1908 ..	15·82	6,442,593	£33,387 4 6	1·24	630,538	53
December 31st, 1908	17·00	6,464,785	£33,168 2 6	1·23	818,355	53
June 30th, 1909 ..	17·00	6,273,276	£31,623 8 7	1·20	807,960	53
December 31st, 1909	21·28	6,896,172	£35,887 8 4	1·25	936,238	60

The meeting of the company was held on February 10th, at 83, Cannon Street, E.C., Mr. A. R. Monks presiding. The Chairman said that the accounts were very satisfactory, having regard to the severe trade depression and bad weather. The gross profit for the year showed an increase of about £600. They had transferred £8,500 to reserve for depreciation as compared with £7,500 for the year 1908, and had also written over £900 off cost of orders, repair shop equipment, &c. The balance of the profit enabled them to pay a dividend for the year of 5½ per cent., and, after reserving £1,618 for local authorities, to carry forward over £1,300 to the accounts for the current year. For 1908 they paid a dividend of 6 per cent., but they had, of course, for the past year to pay dividend on the additional capital called up for the construction of the extensions. The capital expenditure during the year amounted to over £45,000. They only issued £35,000 new shares, the balance of the expenditure being paid for out of reserves. They now had a reserve fund for depreciation of £31,500, and had since the opening of the lines written over £8,500 off cost of orders, repair shop equipment, tools, &c. Mr. H. C. Levis seconded the resolution, which was carried unanimously.

Cambridge Electric Supply Co., Ltd.

The report of the directors for the year 1909 states that there have been connected 175 additional consumers, having the equivalent of 6,407 (30-watt) lamps, making a total to date of 65,979, whereas in 1908, 102 consumers were connected with 3,924 lamps. In spite of the great increase in the number of new consumers, the number of units supplied during the year has been only 621,448, a decrease of 38,710 units. Owing to the greatly increased use of the new metallic-filament lamps (referred to in the last report of the directors), which consume much less energy than the old carbon lamps, the company's receipts for the year have been greatly reduced by reason of the decrease in the number of units sold. The consequent cheapening of the electric light has however been the means of obtaining a record number of new consumers. These include Emmanuel, Pembroke, Corpus and Magdalene Colleges, Ridley Hall, and the General Post Office, most of whom have, however, only been connected three months of the year. Your directors have, therefore, every reason to believe that the prospects of the company are encouraging. A number of premises are now being wired, and the supply mains have had to be extended in several directions. The directors, after very careful consideration, have taken out an insurance policy for the redemption of the leasehold property of the company at the expiry of the lease. The accounts of the company show a total profit for the year of £7,350, which, added to £123 brought forward from 1908, makes £7,473. After deducting debenture and other interest, £1,754, placing £1,000 to depreciation fund account, which will bring up the total placed to the credit of that account to £14,000, and writing £500 off suspense account, there remains a balance of £4,218. An interim dividend of 2 per cent., absorbing £1,696, has already been paid and the directors recommend the payment of a further dividend of 2 per cent., making 4 per cent. for the year. This will absorb £1,696, leaving a balance to carry forward of about £826.

Companies Struck off the Register.—The following companies have been struck off the register, and are accordingly dissolved:—

Chitty Dynamo and Motor Co., Ltd.
French Victoria Accumulator Co., Ltd.
Gutta-Percha Corporation, Ltd.
H. M. Salmony & Co., Ltd.
Premier Electric Lamp Syndicate, Ltd.
Special Telephone Directories, Ltd.
Steam Boilers Circulators' Co., Ltd.
Warrington and District Electric Light and Power Co., Ltd.

MARKET QUOTATIONS

Wednesday, February 16th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	5/-	..
a „ Nitric .. .. „	22/-	..
a „ Oxalic .. .. „	28/-	..
a „ Sulphuric .. .. .. „	5/6	..
a Ammoniac, Sal .. .. .. „	42/-	..
a Ammonia, Muriate (crystal) .. per ton	£29	..
a „ „ .. .. .. „	£30	..
a Bleaching powder .. .. .. „	£5 10	..
a Bisulphide of Carbon .. .. „	£18	..
a Borax .. .. „	£16	..
a Ferro-Silicon (50 %) .. .. „	£10 10	..
a Copper Sulphate .. .. .. „	£19	..
a Lead, Nitrate .. .. .. „	£27	..
a „ White Sugar .. .. .. „	£28 10	..
a „ Peroxide .. .. .. „	£32	..
a Methylated Spirit .. .. .. per gal.	2/6	..
a Potassium, Bichromate, in casks per lb.	8½d.	..
a Potash, Caustic (75/80 %) .. per ton	£20	..
a „ Chlorate .. .. .. per lb.	8½d.	..
a „ Perchlorate .. .. „	4d.	¼d. inc.
a Potassium, Cyanide .. .. „	7d.	..
a Shellac .. .. per cwt.	75/-	..
a Sulphate of Magnesia .. .. per ton	£4 10	..
a Sulphur, Sublimed Flowers .. „	£6 10	..
a „ Recovered .. .. „	£5 10	..
a „ Lump .. .. .. „	£5	..
a Soda, Caustic (white 70 %) .. „	£11	..
a „ Chlorate .. .. per lb.	3½d.	..
a „ Crystals .. .. .. per ton	£3 5	..
a Sodium Bichromate, casks .. per lb.	3d.	..
a „ Cyanide (basis 100 %) .. „	7d.	..
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	£75	..
b „ Wire, in ton lots .. „	£112	..
b „ Sheet, in ton lots .. „	£120	..
p Babbitt's metal ingots .. .. „	£38 to £145	..
c Brass (rolled metal 2" to 12" basis) per lb.	7¾d.	..
c „ Tube (brazed) .. .. „	9¼d.	..
c „ „ (solid drawn) .. „	7¾d.	..
c „ Wire, basis .. .. .. „	6¾d.	..
c Copper Tubes (brazed) .. .. „	9¼d.	..
c „ „ (solid drawn .. „	9¼d.	..
g „ Bars (best selected) .. per ton	£73	£1 dec.
g „ Sheet .. .. .. „	£74	..
g „ Rod .. .. „	£74	..
e „ (Electrolytic) Bars .. „	£62 10	£1 10 dec.
e „ „ Sheets .. „	£78 10	£1 10 dec.
e „ „ Rod .. „	£67	£1 10 dec.
e „ „ H.C. Wire per lb.	8 1/16d.	1/16d. dec.
f Ebonite Rod .. .. .. „	3/8	..
f „ Sheet .. .. .. „	3/-	..
n German Silver Wire .. .. „	1/6	..
h Gutta-percha, fine .. .. .. „	5/6 to 6/6	..
h India-rubber, Para fine .. .. „	8/7	11d. inc.
l Iron Pig (Cleveland warrants) .. per ton	51/4	5d. dec.
l „ Wire, galv. No. 8, P.O. qual. „	£14	..
g Lead, English Ingot .. .. „	£13 15	dec.
m Manganin Wire No. 28 .. .. per lb.	6/6	..
g Mercury .. .. per bot.	£9 7 6 to £9 10	dec.
d Mica (in original cases) small .. per lb.	6d. to 1s.	..
d „ „ „ medium „	2/6 to 4/-	..
d „ „ „ large .. „	4/6 to 8/6	..
p Phosphor Bronze, plain castings „	11½d.	..
p „ „ rolled bars & rods „	1/3	..
p „ „ rolled strip & sheet „	1/3	..
o Platinum .. .. per oz.	120/-	variable.
c Silicium Bronze Wire .. .. per lb.	9½d.	¼d. dec.
r Steel Magnet, in bars .. .. per ton	£55	..
g Tin, Block (English) .. .. „	£119 to £150	£3 inc.
n „ Wire, Nos. 1 to 16 .. .. per lb.	1/9½	¼d. inc.
p White Anti-friction Metals:—		
"Ibis" brand .. .. .. per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.) „	£27 10	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
l Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd
p London Phosphor Copper & Bronze Co., Ltd.
r W. F. Dennis & Co.

London Electric Wire & Smiths, Ltd.—The directors, after placing £5,000 to reserve, recommend a dividend of 7½ per cent. (7s. 6d. per share) on the ordinary shares for the half-year to December 31st, making 10 per cent. for the year, carrying forward £2,088.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following securities to be quoted in the Official List:—

County of London Electric Supply.—Further issue of £50,000 4½ per cent. second debenture stock.

Manaos Tramways and Light.—£300,000 5 per cent. first debentures, Nos. 1 to 3,000 of £100 each, in lieu of the scrip.

Manitoba.—Further issue of 4 per cent. debenture bonds (telephone and telegraph systems), 1947.

The Stock Exchange Committee has ordered the undermentioned securities to be quoted in the Official List:—

Madras Electric Supply Corporation.—60,000 ordinary shares of £5 each, fully paid, Nos. 1 to 60,000, in lieu partly of the 5 per cent. construction debenture stock now quoted. Melbourne Electric Supply Co.—Further issue of £100,000 5 per cent. first mortgage debenture stock. Oriental Telephone and Electric Co.—Further issue of £50,000 4 per cent. redeemable debenture stock. Southern Electric Tramways Co., Buenos Ayres (Compania de Tramways Electricos del Sud).—£98,400 5 per cent. first mortgage debentures, within Nos. 1 to 900 of £100 and 901 to 1,900 of £20 each, in lieu of the scrip.

STOCKS AND SHARES.

Tuesday Afternoon.

Business on the whole is better in the Stock Exchange. The quieter position of the rubber market is a good thing for other departments, which had come to be overshadowed by the widespread interest in the gamble of the moment. The reduction to 3 per cent. in the Bank Rate has had a salutary influence upon most of the investment sections, although the prospect of heavy new issues in the near future makes for depression in Consols, and their immediate circle.

It amazes many even of the authorities to see how the rubber boom keeps up. There must be comparatively few proprietors left who have had the courage to retain their shares all through the rise. Each advance has shaken out some of the shareholders, but their places—and their shares—have been eagerly taken by others, and now the market has a *clientèle* immensely wide.

Orders come from the Middle East, from the Continent, a few even from the United States, and in shoals they come from all parts of the British Isles. The gamble has arrived at that stage where danger must be apprehended, and the unscrupulous promoter, the bucket-shop and the knave, are wide awake to the possibilities that the rubber market offers for the employment of their peculiar talents. Prices are strong, and at present there is little sign of the boom coming to an early termination.

Amongst the movements chronicled in the next page, the largest is a rise of 6 in Mexican Light and Power Common shares, there being steady purchases by well-informed people. Next in point of value comes a spurt in London United Tramways Debenture stock, which has carried up the price to 72½. The resignation of Sir Clifton Robinson has, therefore, done the debenture stockholders no harm so far. The company's shares are unchanged. British Electric Tractions have reacted to some extent, but the second Debenture stock gained a point. The tendency is to put up prices of prior charge stocks of all kinds, from such a security as Edmundson's Debenture, which has risen 4, to a number of other Debentures with improvements of ½ or 1 to their credit.

Cape Electric Trams, after long lifelessness, rose to 6s. 3d. middle. Dublin United Trams, too, are substantially higher. The Railway issues, on the other hand, are no better, although the railway market is not at all a bad one. The better feeling in regard to Home Rails does not seem to have filtered through to Tube stocks, the prices of which are mostly depressed. Districts and Central London Ordinary show small rises, and Underground Electric Railway 4½ per cent. bonds at 89 are 2 points higher on the week.

Very substantial rises have taken place in Rosario Electric Preference shares, the Seconds putting on as much as 2½ at 8⅝, while the Firsts improved 7s. 6d. to 6¼. This is due to the proposals of a Belgian company to buy up the Rosario Electric shares upon very favourable terms. Following this sensation, there is little to report. The rise in Edmundson's Debenture has been already referred to. City shares pursued their upward course with a further 5s. rise. London Electric Preference, County Preference, Charing Cross and City Preference, and Metropolitan Ordinary shares are each ½ better. One or two of the provincial issues are in demand, noticeably Hove and Oxford, but Newcastle-on-Tyne Ordinary went back a little.

Modest improvements in Anglo-American Telegraph stocks would probably have made more headway had it not been for the curbing influence of the Wall Street railroad market. As it is, the Deferred, after its tumble of 1⅛ a week ago, shows a recovery of the fraction, ⅜, only. In other telegraph descriptions the tone is firm, and there are a fair number of small rises. National Telephone issues are decidedly firm, the lead being taken with a 2½ points rise in the Deferred stock, bringing it up to 127 middle. United River Plate Telephone and Chili Telephone participate in the firmer aspect of the market as a whole.

Babcock & Wilcox shares are the features in the miscellaneous list, the price of the Ordinary being ½ better at 5½. The buying still bases its operations upon the new naval programme which the Government—whichever Government that may be—are likely to introduce during the spring. Henley's rose another ½. Electric Constructions at ⅝ show a small loss. There has been a distinct recovery in British Aluminium shares.

Continental.—Deutsche Beck-Bogenlampen-Gesellschaft m.b.H., Frankfurt a/M.—According to a resolution of the shareholders at a meeting on January 15th, 1910, the capital of the above-named firm was raised to M. 1,715,000.

Germany.—The Deutsche Ueberseeische Electricitäts Gesellschaft, of Berlin, is increasing its capital from £4,000,000 to £4,500,000.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years. 1906.	1907.	1908.	1909.	Closing Quotations Feb. 8th.	Closing Quotations Feb. 15th.	Business done week ended Feb. 15th, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3⅜ — 3⅝	3⅜ — 3⅝	..	..	..	Nil.
186,700	Do. do. 5 % Debs., Nos. 1 to 1,950 Red.	100	5 %	5 %	5 %	5 %	99 —102	99 —102	..	..	..	4 18 0
$121,551,400	American Telephone & Telegraph, Cap. Stock ..	$100	8 %	8 %	8 %	8 %	138 —140	140 —142	..	..	+2	5 12 8
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	94 — 96	94 — 96	..	..	..	4 3 4
558,460	Anglo-American Telegraph	Stock	3½%	3½%	£3 4s.	3⅜%	60 — 62	59 — 61 xd	..	..	..	5 19 4
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	100½—101½	99⅜—100½ xd	100½	99⅞	..	5 19 1
3,220,770	Do. do. do. Deferred	Stock	1¾%	1 %	8/-	25/-	19⅛— 19½	18½ — 19 xd	19⅛	18⅛	..	6 11 7
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	..	101 —103	101½—103½	..	..	+ ½	4 16 7
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	7⅞— 8⅛	7¾— 8⅛	..	..	+ 1/16	4 16 8
2,431,350	Commercial Cable, Sing. 500 year 4% Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	86 — 88	89½ — 88½	87⅛	87	+ ⅛	4 10 5
16,000	Cuba Telegraph	10	5 %	6 %	6 %	..	8¼— 9¼	8½— 9¼	8 1/16	..	..	6 9 9
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	..	17 — 18	17 — 18	..	..	..	5 11 1
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3 — 3½	3 — 3½	..	..	..	5 14 8
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	..	8 — 8½	8 — 8½	..	..	..	6 5 0
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
60,710‡	Direct United States Cable	20	4½%	4½%	4½%	..	13¾— 14¼	13¾— 14¼	14	13⅞	..	5 19 1
30,500‡	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99½—101½	..	..	+ ½	4 8 8
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	..	134 —137	135 —138	137½	136	+1	5 1 b
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	85½— 87½	86 — 88	87⅞	86⅞	+ ⅛	4 1 5
1,996,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	102½—104½	102½—104½	..	..	..	3 16 7
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	..	12⅜— 12⅝	12⅜— 12⅝	12 1/32	12 1/32	..	5 8 9
762,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
200,000‡	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 8
181,127	Globe Telegraph and Trust	10	5⅝%	5⅝%	5⅝%	..	10⅜— 10⅝	10⅜— 10⅝	10⅜	10 3/32	..	5 6 1
181,127	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	13⅜— 13⅝	13⅜— 13⅝	13⅜	13 1/16	..	4 6 6
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	20 %	18 %	..	29½ — 30½	29½ — 30½	..	..	..	5 16 2
5,000‡	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	98½—100½	99½—101½	..	..	+1	4 8 8
17,000	Indo-European Telegraph	25	13 %	13 %	13 %	..	51 — 53	51 — 53	53	53½	..	6 2 8
$41,380,400	Mackay Companies Common	$100	3½%	4 %	4 %	4½%	91 — 93	91 — 93	..	..	..	4 11 3
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	78 — 83	77 — 82	..	..	—1	4 17 7
394,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	3⅛— 3⅜	3⅛— 3⅜	15/3	14/-	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	..	1/16— 1/8	1/16— 1/8	..	..	..	6 8 0
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	3/16— 1/4	3/16— 1/4	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	8 %	8 %	8 %	6 %	107 —108½	107½—109	108½	107½	+ ½	5 10 1
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	123½—125½	126 —128	127½	125	+2½	4 13 9
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	10½ — 11½	10¾— 11½	..	..	..	5 6 8
15,000	Do. do. 6 % Cum. 2nd Pref.	10	5 %	6 %	6 %	6 %	10½ — 11	10¾— 11	..	..	..	5 9 1
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅞— 5 11/16	5⅞— 5⅞	..	..	+ 1/16	4 6 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	98 —100	98 —100	98½	..	..	3 10 0
1,983,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
179,813	Oriental Telep. and Elec., 1 to 171,504, fully paid ..	1	7 %	8 %	8 %	..	1⅜— 1½	1⅜— 1½	..	..	..	5 5 9
50,000	Do. do. do. 6 % Cum. Pref.. ..	1	6 %	6 %	6 %	..	1 3/16— 1 5/16	1 3/16— 1 5/16	..	..	..	4 14 9
99,100	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	86½	..	..	4 10 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98 —100	98 —100	98	..	..	4 0 0
11,889	Reuter's	8	5 %	5 %	5 %	..	7⅞— 8¼	7⅞— 8¼	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	99½—101½	100 —102	..	..	+ ½	4 8 3
3,042	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	130 —133	130 —133	..	..	..	4 10 3
120,000	United River Plate Telephone	6	8 %	8 %	8 %	..	7⅛— 7⅜	7⅛— 7⅛	7⅛	7 1/16	+ 1/16	5 7 9
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	6	5 %	5 %	5 %	..	4⅜— 5	4⅜— 5⅛	..	..	+ ⅛	4 17 7
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 53,008	2½	2½%	2½%	2½%	..	1⅜— 1⅝	1⅜— 1⅝	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	13⅜— 14½	13⅜— 14½	14	13⅜	..	4 18 3
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	102⅜	101	..	3 17 8
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	..	8¾— 9¼	8¾— 9¼	..	..	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£3 6	18 %	..	8 — 9	8 — 9	..	..	..	6 13 4
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100½—102½	100½—102½	..	..	..	4 17 7

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1st Pref., 1 to 640,000	5	..	..	..	..	4⅛— 4⅜	4⅛ — 4⅜	93/1¼	90/7½	..	5 5 5
500,000	Do. 5 % 2nd Pref., 500,001 to 1,000,000	5	..	..	..	..	4⅛— 4⅜	4⅛— 4⅜	85/7½	..	..	5 14 3
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	90 — 91½	90½— 92	91½	91	+ ½	4 7 0
462,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —106	104 —106	..	..	..	4 14 4
880,000	Babcock & Wilcox, 1 to 880,000	1	20 %	20 %	20 %	..	4⅛— 4⅛	5⅛— 5⅛	5⅛	5⅛	+ ⅛	3 16 11
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	..	1 1/16— 1 1/16	1 1/16— 1 1/16	21/3	20/-	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	Nil	..	⅜ — ½	⅜ — ½	..	..	..	Nil
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	3½%	..	¾ — 1	¾ — 1	22/6	..	+ ½	..
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	..	2 — 3	2½— 3½	..	..	+ ½	..
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	2 %	..	1 — 2	¾ — 1½	..	..	— ½	..
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	5½%	5½%	5½%	5½%	95 — 98 xd	95 — 98	..	..	..	..
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	8 %	8 %	8 %	140 —144	139 —143	1 01/32	..	—1	5 11 11
400,000	Do. Pref. Ord. Stock	100	6 %	6 %	6 %	6 %	116 —120	116 —120	119¼	117½	..	5 0 0
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	108 —110	109 —111	111	109⅝	+ ⅛	4 10 1
233,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	102 —104	102 —104	..	..	..	4 6 7
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	101 —104	101 —104	..	..	..	4 6 7
188,801	British Electric Traction	10	Nil	Nil	Nil	..	1¼— 1½	1 — 1⅛	..	..	— ½	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	8 %	1¾%	..	3¾— 4	3½— 3⅝	71/3	67/6	— ½	4 0 0
1,479,668	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	89 — 92	89 — 92	90½	90	..	5 8 8
538,986	Do. do. 4½ % 2nd Deb. Stock Red.	100	4½%	4½%	4½%	..	67 — 72	68 — 73	..	..	+1	6 6 3
100,000	British Insulated and Helsby Cables	5	10 %	10 %	10 %	..	7⅜— 7⅞	7⅜— 7⅞	..	..	..	6 9 0
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6⅞— 7 xd	6⅞— 6⅞	6⅞	..	..	4 10 7
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	103½	..	..	4 4 11
904,940‡	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	4½%	89 — 94	89 — 94	..	..	..	4 15 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	..	⅛— ¼	⅛— ¼	..	..	..	Nil
1,816,358	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	47 — 51	47 — 51	..	..	..	7 16 10
50,000	Brownett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	1/16— 1/8	1/16— 1/8	..	..	..	Nil
50,000	Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
125,000‡	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	..	41 — 46	41 — 46	..	..	..	9 16 8
125,000‡	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	..	25 — 29	25 — 29	..	..	..	15 3 0
187,610	Calcutta Trams, 1 to 187,610	5	8 %	6 %	4½%	..	4½— 4⅞	4½— 4⅞	88/9	..	..	4 14 9
45,304	Do. 5 % Cum. Pref., Nos. 1 to 39,330..	5	5 %	5 %	5 %	..	4⅜— 5	4⅜— 5	..	..	..	5 0 0
960,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	99 —102	98 —101	98	..	—1	4 9 1
35,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	10⅛— 10⅞	10⅛— 10⅞	..	..	..	6 17 11
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5⅛— 5⅜	5⅛— 5⅜	..	..	..	4 10 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102½—104½	102½—104½	..	..	..	4 6 2
491,292	Cape E. Trams., 1 to 491,292	1	Nil	Nil	Nil	..	1/16— 1/8	1/16— 1/8	..	..	+ 1/16	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	8 %	12 %	12½%	..	2⅜— 2½	2⅜— 2½	50/-	42/6	..	5 0 0
210,158	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	104 —107	104 —107	..	..	..	4 4 1
1,890 600	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	64 — 66	63 — 65	63½	62¾	—1	4 12 4
554,555	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	85 — 87	84 — 86	84½	84½	—1	4 13 0
554,555	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	46 — 48	44 — 46	44½	..	—2	4 7 0
1,480,000	City and South London Railway	Stock	2½%	2½%	1¼%	1½%	31½— 32½	30½— 31½	..	..	—1	5 11 1
85,000	Crompton & Co., Nos. 1 to 85,000	5	5 %	5 %	Nil	..	⅜ — ½	⅜ — ½	..	..	..	Nil
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(*Continued.*)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909	Closing Quotations Feb. 8th.	Closing Quotations Feb. 15th.	Business done week ended Feb. 15th, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	10 %	10 %	6 %	..	1 — 1⅛	1 — 1⅛	..	..	..	6 0 0
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000 ..	1	6 %	6 %	6 %	..	1⅛ — 1⅛	1⅛ — 1⅛	..	..	..	5 9 1
271,080	Do. do. 4½ % Deb. Stock	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	19⅜ — 18⅜	18 — 14 xd	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	4½%	2½%	Nil	..	⅝ — ½	⅝ — ½	..	..	..	Nil
17,189	Do. "A" shares, 01—017,189 ..	5	4½%	2½%	Nil	..	1 — 1⅛	1 — 1⅛	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	64 — 69	64 — 69	..	..	..	5 15 11
67,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	81 — 84	81 — 84	..	..	..	5 19 1
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	1/16 — 1/8	⅛ — ¼	..	..	— 1/16	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890..	2	7 %	7 %	7 %	..	1⅛ — 1⅛	1⅛ — 1⅛	..	..	..	10 4 0
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	..	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	6 1 3
2 10,000	Do. do 4 % Mort Deb... ..	Stock	4 %	4 %	4 %	..	83 — 87	83 — 87	..	..	..	4 12 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	¼ %	Nil	..	⅜ — ½	⅜ — ½	..	..	..	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	..	10½ — 10⅞	10½ — 10⅞	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 —103½	102 — 103	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	5 %	15%	15 %	..	12⅛ — 12⅞	12½ — 13	12⅜	..	+ ⅛	5 15 5
40,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	..	5 — 5⅛	5 — 5⅛	..	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½%	4½%	4½%	..	105 —107	106½ —107½	..	..	+ ½	4 3 9
80,000	India-Rubber, Gutta-percha & Telegraph Works..	10	0 %	10 %	10 %	10 %	15 — 15⅞	15 — 17⅞	15⅞	15½	..	6 7 0
27,500	†Liverpool Overhead Railway, Ord.	10	Nil	½%	Nil	Nil	¹⁵/₁₆ — 1 1/16	¹⁵/₁₆ — 1 1/16	..	..	..	Nil
10,000	† Do. do. Pref., fully paid ..	10	5 %	5 %	5 %	5 %	4½ — 5	4⅝ — 5⅛	..	..	+ ⅛	9 10 6
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	Nil	..	1½ — 2½	1⅝ — 2½	..	..	..	Nil
999,980	Do. do. 60,008 to 100,000	10	3 %	3 %	Nil	..	1½ — 2½	1⅝ — 2⅜	..	..	..	Nil
195,000	Do. do. 5 % Cum. Pref., 1 to 195,000	10	5 %	5 %	3⅜%	..	1⅞ — 2⅜	1⅞ — 2⅜	42/6	..	..	16 15 10
1,649,930	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	..	4 %	4 %	67 — 71	71 — 74	73	70	+3½	5 8 1
4,732,062	Metropolitan Consolidated	100	1 %	½%	1½%	1 %	38½ — 39⅜ xd	38⅝ — 39½	39⅜	38½	..	2 11 7
2,640,914	Do. Surplus Lands	100	2½%	2½%	2½%	2⅜ %	6½ — 6⅝ xd	66 — 68	67½	67½	..	4 0 11
5,295,000	Do. District	100	Nil	Nil	Nil	Nil	17 — 17½	17½ — 17⅞	17¼	17⅛	+ ½	Nil
891,397	Metropolitan Electric Trams., Ord.	1	..	..	4½%	..	¹⁵/₁₆ — 1	¹⁵/₁₆ — 1	..	..	..	6 10 11
814,016	Do. do. Defd...	1	Nil	Nil	Nil	..	⅜ — ⅝	⅜ — ⅝	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref. ..	1	5 %	5 %	5 %	..	⅝ — ¾	⅝ — ¾xd	16/3	15/6	..	5 14 3
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½%	4½%	4½%	4½%	92 — 95	92 — 95	94	..	..	4 14 9
$10,833,200	Mexico Trams Co., Common Stock	..	..	..	..	..	130 —132	130 —132	132½	130⅝	..	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	..	5 %	94½ — 96½	96 — 98	97⅛	95½	+ 1½	5 2 0
245,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	⅝ — ¾	⅝ — ¾	..	..	..	..
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	..	⅝ — ¾	⅝ — ¾	..	..	..	6 17 11
245,000	Do. 4½ % Deb. Stock	100	4½%	4½%	4½%	..	84 — 87	84 — 87	..	..	..	5 3 6
57,350	Telegraph Construction and Maintenance	12	15 %	17½%	15 %	17½%	94½ — 96	85½ — 87	96	..	+1	5 12 11
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	99¾ —101½	100 —102	101	100½	+ ½	3 18 5
1,000,000	Underground Electric Railway, 5% Prior Lien ..	..	..	..	5 %	..	101 —103	101 —102	102	..	..	4 18 0
2,800,000	Do. do. 4½% Bonds	..	..	..	4½%	..	86 — 88	88 — 90	89	88½	+2	5 0 0
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	32 — 34	32 — 34	32⅜	..	..	..
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	1	Nil	10 %	5 %	..	⅜ — ½	⅜ — ½	..	..	..	..
66,666	Do. 6 % C.P., 80,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	..	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	2 8 4
245,496	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	..	70 — 75	68 — 73	..	..	—2	5 9 7

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5½%	5½%	5½%	..	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	15 9
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½%	4½%	4½%	..	91 — 94	91 — 94	..	..	..	4 18 9
80,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	..	7⅛ — 7⅜	7⅛ — 7⅜	7⅛	..	..	6 1 8
2,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	7⅛ — 7⅜	7⅛ — 7⅜	7⅛	..	..	4 4 10
400,000	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
80,000	Charing Cross and Strand Electricity Supply ..	5	5 %	5 %	5 %	..	8¼ — 4⅜	8⅞ — 4⅜	85/-	..	..	5 14 3
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4⅛ — 4⅜	4 — 4½	..	..	— ⅛	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	8⅞ — 4⅜	8⅞ — 4⅜	..	..	+ ⅛	5 2 10
445,736	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	96 — 99	95⅜ — 97⅜	96	..	—1	4 2 1
49,486	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	8½ — 8¾	8½ — 8¾	..	..	..	6 0 0
175,000	Do. do. 4½ % Deb. Stock Red. ..	Stock	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
70,595	City of London Elec. Lighting, Ord. 40,001—110,596	10	6 %	6 %	6 %	6 %	11½ — 11⅝	11 — 12	12	11⅝	+ ⅛	5 0 0
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12½ — 13½	½ — 13½	..	..	..	4 10 7
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	121 —125	121 —130	123½	..	..	4 0 0
300,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99 —102	99 —103	..	..	..	4 8 3
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	..	..	1½ — 2	1⅝ — ..	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref. ..	5	5 %	5 %	5 %	..	2½ — 3⅜	2⅝ — ..	..	..	..	7 8 2
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	91 — 93	91 — ..	..	..	..	5 7 6
40,000	County of London Electric Lighting, Ord. 1—40,000	10	5 %	5 %	5 %	5 %	7⅛ — 8	7 — ..	..	..	..	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	..	10⅝ — 11½	10⅜ — 11½	10 15/16	..	+ ⅛	5 6 8
400,000	Do. do. 4½ % Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	103 —106	103 —106	105½	..	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock ..	Stock	4½%	4½%	4½%	..	98 —101	99 —102	..	..	+1	4 8 3
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	Nil	Nil	Nil	..	⅛ — ⅜	⅛ — ⅜	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	3 %	Nil	Nil	..	⅛ — ⅜	⅛ — ⅜	14/4½	..	..	Nil
420,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	64 — 67	68 — 71	..	..	+4	6 6 9
$5,160,000	Electrical Dev.Co.of Ontario, 5% 1stMtg.Gold Bnds.	$500	..	..	5 %	5 %	81 — 84	81 — 84	83¾	81½	..	5 19 1
10,000	Folkestone, 1 to 10,000	5	5½%	5½%	5½%	..	4⅜ — 4⅞	4⅜ — 4⅞	..	..	..	5 12 10
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	..	4⅝ — 5⅛	4⅝ — 5⅛	..	..	..	4 13 0
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	95 — 98	95 — 98	..	..	..	4 11 10
15,000	Hove, 1 to 15,000	5	9 %	8½%	8½%	..	6⅞ — 7⅛	6⅞ — 7⅛	7 5/16	7⅛	..	5 13 4
$1,376,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	102⅛ —104½	102⅛ —104⅛	..	..	..	4 15 8
21,000	Kensington and Knightsbridge Electric Ord. ..	5	10 %	10 %	8 %	..	7 — 7⅛	7 — 7⅛	..	..	..	5 4 1
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94½ — 96⅜	94½ — 96⅜	..	..	..	4 2 11
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½%	3 %	..	1½ — 2⅛	1⅝ — 2⅛	..	..	..	4 4 3
70,000	Do. do. 6 % Pref.	5	6 %	6 %	6 %	..	4⅝ — 5¼	5 — 5⅜	..	..	+ ⅛	5 11 8
862,355	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4½%	4 %	4 %	91 — 93	91½ — 93½	92½	..	+ ½	4 5 7
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½%	5 %	..	4 — 4½	4⅜ — 4⅝	86/3	83/1½	+ ⅛	5 8 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	..	4⅝ — 5	4⅝ — 5	93/1½	..	..	4 10 0
285,000	Do. 4½ % 1st Mort. Deben. Stock ..	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83 — 86	83 — 86	..	..	..	4 1 6
$6,000,000	Mexican Electric Light Co.. 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	..	81 — 83	81 — 83	83½	81½	..	6 0 6
£8,585,000	Do. Light and Power Co., Ltd., Common ..	$100	..	..	3½%	..	68 — 70	74 — 76	76½	70½	+6	4 12 1
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	..	100 —104	101 —105	103½	102	+1	6 13 4
£2,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	88 — 90	90 — 91	90½	89½	+1½	5 9 11
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96 — 98	96 — 98	97½	..	..	4 11 10
130,491	Newcastle-on-Tyne, 1 to 137,500	5	8 %	8 %	2½%	..	4 — 4½	3⅞ — 4⅛	8/-	..	— ⅛	2 17 1
137,500	Do. 5 % Pref., 1 to 137,500	5	5 %	5 %	5 %	..	4½ — 5	4½ — 5	..	..	..	5 11 1
125,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	5 %	99 — 101	99 —101	..	..	..	4 19 0
19,353	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	12½ — 13½	12½ — 13½	12⅜	..	..	5 6 0
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	..	7 %	6 — 6½	6½ — 6⅝	..	..	+ ⅛	3 16 9
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	93 — 96	93 — 96	..	..	..	4 1 8
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507 ..	1	2½%	6 %	8 %	..	1½ — 1⅝	1⅝ — 1½	33/9	32/6	+ 1/16	4 11 10
100,000	Do. do. 6% Non Cum. Pref. Nos.1 to 100,000	1	6 %	6 %	6 %	..	1 3/32 — 1 5/32	1 3/32 — 1 5/32	..	..	..	5 19 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	101 —104	101 —104	..	..	..	4 16 2
40,000	St. James' and Pall Mall Electric Light, Ord. ..	5	10 %	10 %	10 %	10 %	8¾ — 9	8¾ — 9	8 15/16	..	..	6 7 0
80,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	7 — 7⅛	7 — 7⅛	..	..	..	5 11 1
150,000	Do. do. 3½ % Deb. Stock Red. ..	100	3½%	3½%	3½%	3½%	83 — 87	83 — 87	..	..	..	4 0 6
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	2 — 2½	2 — 2½	..	..	..	Nil
65,000	South London Electric Supply, Ord.	4	5 %	4 %	5 %	5 %	2⅜ — 3½	2⅜ — 3½	..	..	..	9 6 1
130,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	100 —103	100 —103	..	..	..	..
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	7/16 — 9/16	7/16 — 9/16	..	..	..	4 8 11
142,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	..	1 1/32 — 1 3/32	1 1/32 — 1 3/32	..	..	..	5 15 6
294,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	..	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	⅜ — ½	⅜ — ½	..	..	..	25 6 8
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	14 5 4
275,000	Do. do. 4½ % 1st Mort. Db. Stk. Red.	100	4½%	4½%	4½%	..	74½ — 78½	74½ — 78½	..	..	..	5 14 8
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000 ..	1	..	..	5 %	..	1/16 — 1/8	1/16 — 1/8	..	..	..	5 6 8
100,000	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8⅞ — 9½	8⅞ — 9½	8⅞	..	..	5 9 7
51,279	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	4½ — 5⅛	4½ — 5⅛	97/6	..	..	4 3 9

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 3% per cent. February 10th, 1910.

TANGYES' ELECTRICALLY-DRIVEN PUMPS.

Few of the great engineering firms of the United Kingdom are better known in all quarters of the globe than are Messrs. Tangyes Ltd., of Cornwall Works, Soho, Birmingham. The history of the development of the business is full of interest to all who have an admiration for initiative and enterprise. Pioneered by men of practical engineering knowledge who possessed an indomitable pluck and energy, and developed with a great foresight and an adaptability to the world's requirements in various departments of engineering manufactures, a vast and world-wide organisation has been built up. The fact that we live in days when the commercial position is very different from that obtaining when this great organisation began to be, does not deprive the story of the rise and progress of the firm of its interest for the active spirits of engineering in these days, nor lessen the value of its lessons. We have large electrical engineering concerns to-day which have developed from something small, but in this day of limited companies the personal factor naturally does not stand out so pronouncedly as it did when the Tangye brothers were evolving their ideas. As would appear from our notes of a few weeks ago on the occasion of the death of Mr. Edward Tangye, it was quite foreign to the nature of these brothers to lose an active interest in their great business—though with growing years they were, perhaps, unable to be in daily connection with it—for long after the generally accepted age for retirement had been reached, they were still bringing their inventive ingenuity to bear in new directions. A business conceived by such spirits and progressing along such lines, gathers around it a *personnel* who regard its affairs as their own, the spirit of the head passing down through the ranks.

We have little doubt that this factor plays a very large part in assuring the success of a business, for all are imbued with a sort of common interest in making things "go." Huge organisations whose heads are always changing, and whose staffs are for ever on the move, in which, though there may be largeness, there is little continuity of *personnel* policy and control, are deprived of this co-operative spirit. Where men are likely to move on every year or two, it is not to be supposed that they will be continuously giving every new employer of their best, though it may be that after many years they become in certain respects the more capable men because of their constant peregrinations.

We are particularly interested in the firm of Tangyes Ltd., because of their large foreign connection, and in the following notes we refer to one department of their business in which electrical application plays an important part—we allude to electric pumping installations. Some of the more recent plant, both for home and foreign service, we have selected for illustration.

Fig. 1 represents one of two sets of horizontal three-throw ram pumps with gun-metal rams, 11⅝ in. × 9½ in., running at 46 R.P.M.; it has cast-iron pump bodies and valve boxes, and will deliver 500 gallons per minute at 80° F., against a total head of 165 ft. (including friction). Each pump is driven by a three-phase semi-enclosed motor (made by the General Electric Co.) of 36 B.H.P. at 220 volts, 18 cycles per second, at a speed of 340 R.P.M. These two pumping sets have been supplied to the Bengal-Nagpur Railway Co., Khargpur Waterworks, for which Sir J. Wolfe Barry, K.C.B., is engineer.

Another Indian installation is that supplied to the Nundydroog Co., Ltd., of 6, Queen Street Place, London, for their colliery in India. It consists of a vertical three-throw geared ram pump (fig. 2), 7½ in. × 10 in., to run at 54 R.P.M., with cast-iron valve boxes, covers, spring boxes, pump bodies and glands. The valve boxes have outside valve springs and gun-metal valves.

It is intended to deliver 250 gallons per minute to a vertical lift of 600 ft. through an incline shaft 56° from the horizontal, making a total head, including friction, of 610 ft.

It is driven by one 75-B.H.P. three-phase induction motor (voltage 220, cycles 25, speed 750 R.P.M.) supplied by Messrs. Dick, Kerr & Co., Ltd.

We show in fig. 3 a two-stage "Tan-Gyro" centrifugal pump, consisting of 2-3 in. pumps, each with one standard, and spindle fitted with flexible coupling for direct coupling to the motor shaft. The two pumps are mounted on a cast-iron underlying base-plate to carry the motor placed between the two. The suction branch of one pump is connected to the delivery of the other by a cast-iron pipe. It is driven by an Electromotors shunt-wound enclosed ventilated continuous-current motor, to give 17 B.H.P. at 1,350 to 1,600 R.P.M. on 220 volts. The set will deliver from 8,000 to 10,000 gallons of water per hour through a nozzle, at a pressure of 60 lb. per sq. in., a total head of 170 ft.

This set was supplied to the Croydon Gas Co., for dealing with water containing a certain amount of coke dust.

Looking now at home, we illustrate in fig. 4 a horizontal geared three-throw ram pump, 5½ in. × 9 in., with outside valve springs, and cast-iron rams. It has a countershaft fitted with a spur wheel gearing into a raw-hide pinion. It is driven by a 9 B.H.P. Westinghouse motor running at 1,000 R.P.M. This pump is capable of delivering 150 gallons per minute—9,000 gallons per hour—against a total

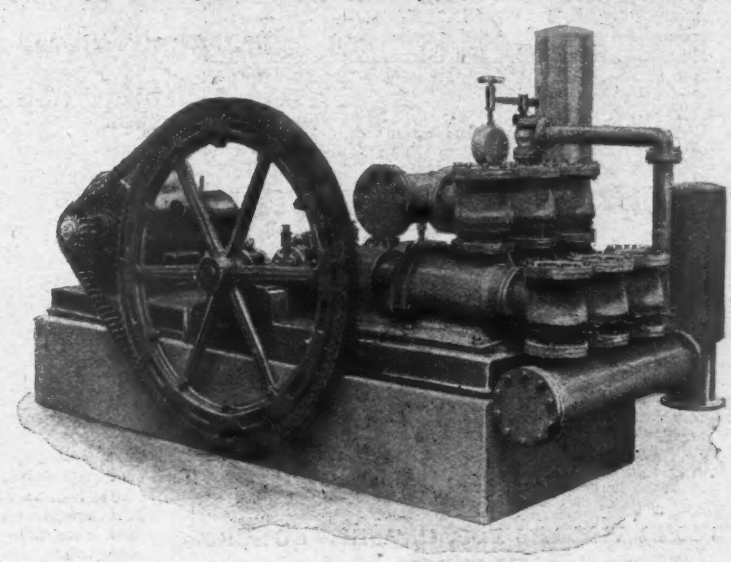


FIG. 1.—ELECTRICALLY-DRIVEN HORIZONTAL TREBLE RAM PUMP WITH CHAIN DRIVE.

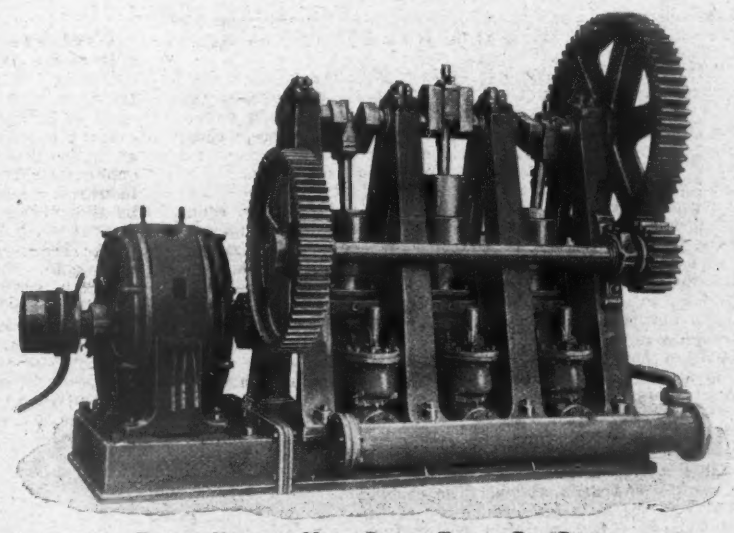


FIG. 2.—VERTICAL MOTOR-DRIVEN TREBLE RAM PUMPS.

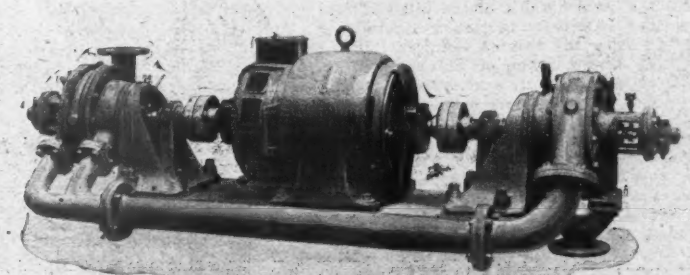


FIG. 3.—TWO-STAGE "TAN-GYRO" CENTRIFUGAL PUMP AND MOTOR.

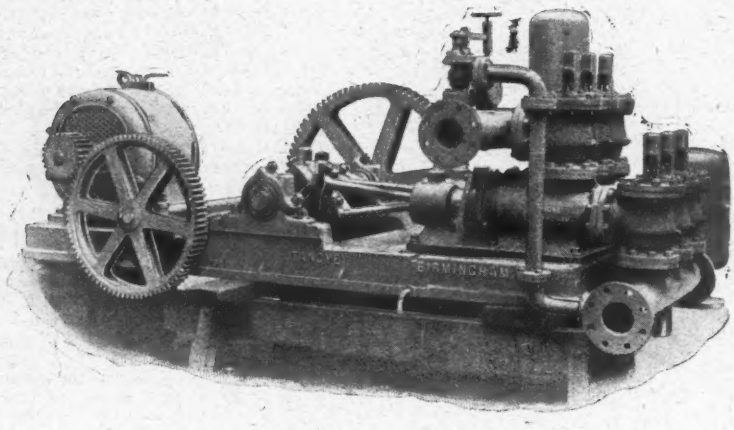


Fig. 4.—Horizontal Geared Treble Ram Pump, with Motor Drive.

head of 130 ft., including friction. This is one of two pumps supplied to the British Westinghouse Electric and Manufacturing Co., for Messrs. Archibald Russell, Ltd., Polmadie, Stirling.

FEEDER PILLARS FOR CAPSTAN CONTROL IN INDIA.

The feeder pillars, one of which is shown in the accompanying illustrations, were produced at the General Electric Co.'s Witton works for use in India.

The problem for the designer was to arrange the complete switch-gear for the control and efficient protection of direct-current 15 H.P. capstan motors, consisting of a double-pole main switch, double-pole fuses, drum type controller, starting resistance, choking coils, lightning arresters and sealing ends for the lead-covered motor cables, in a cast-iron pillar. Weight and dimensions had to be kept within certain given limits to admit of transportation without dismantling. Only such material could be used which would stand the very trying climatical conditions—for instance, no fibre, presspahn, or even slate could be employed. Particular care had to be taken to prevent the ground moisture from rising into the pillar, but at the same time efficient ventilation had to be provided to carry away the heat generated in the starting resistance. Furthermore, the pillars had to be absolutely safe against the torrential rains which fall periodically. As the pillars were to be operated by natives, they had to be what is generally termed "fool-proof," a further difficult condition. The problem, however, has been solved in a thoroughly satisfactory manner.

Reference to the illustrations will show that the pillar is provided with two doors, one at each of the short ends. One of these doors gives access to the choking coils, main fuses and lightning arresters, the other to the controller and main switch. The choking coils and the main fuses, which are of the well-known G.E.C. porcelain bobbin type, are mounted on a white marble slab reaching across the whole width of the pillar, thus separating effectively fuses and lightning arresters from the rest of the gear. The lightning arresters are of the short gap magnetic blow-out series resistance type; they are contained in boxes, and are mounted on the sides of the pillars right and left of the choking coils.

The bottom of the pillar is closed against the cable trench by a diaphragm of boiler plate, through which the lead-covered cables are brought by means of brass screwed glands made tight with steam packing. The controller is placed on this diaphragm, and, as it stands at right angles to its actuating shaft, bevel gearing had to be employed for its operation.

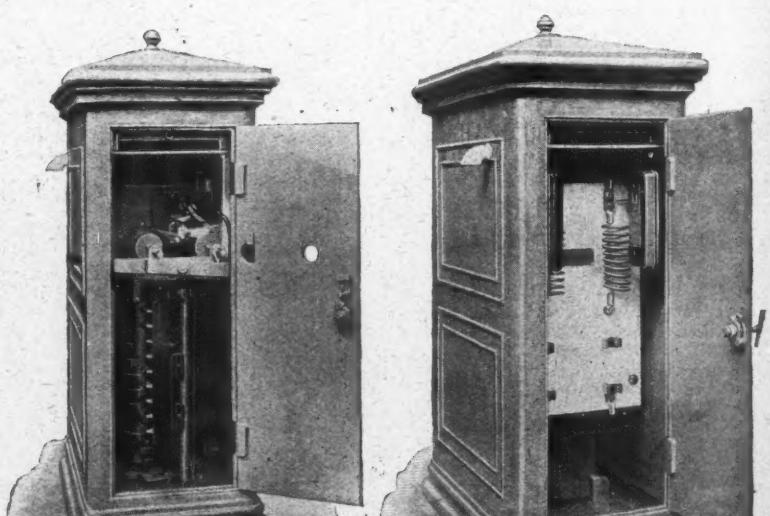
The controller itself offers several novel features; for instance, only micanite is employed as insulating material. The drum consists of solid iron castings clamped on to a square steel shaft covered with a thick coat of micanite, and has the smallest possible air-gap in the way of the magnetic flux, thus considerably increasing the efficiency of the magnetic blow-out. The contact fingers are arranged similarly to the drum castings, on a micanite shaft, with which they form a self-contained unit that can be removed as a whole for inspection and overhauling. The blow-out coil is of very ample proportions, and keeps quite cool with the normal current passing permanently, giving a strong field even with the no-load current of the motor.

The double-pole main switch, of the magnetic blow-out laminated brush type, is mounted on a white marble base which is bolted on one side of the pillar near the controller, with which it is mechanically interlocked in such a way that it cannot be opened unless the controller is in the "off" position, and if the controller drum should be turned for inspection purposes while the switch is "off," it is impossible to close the switch. The actuating shafts of both the main switch and the controller penetrate the door of the pillar, and a further device is provided which securely locks this door as long as the main switch is "on." It will be seen, therefore, that to open the door of the pillar it is necessary, first, to switch off the controller; secondly, to open the main switch; and, thirdly, to remove the switch handles as well as the controller handle. These handles can, of course, only be removed in the "off" position.

The starting resistances are lodged in the top part of the pillars under the covers, so that the heat generated is freely radiated by the covers. Furthermore, ventilating slots are provided in the pillars themselves near the bottom, and under the covers. The slots near the bottom are slanting upwards and inwards at a steep angle to prevent rain water drifting in, while the upper slots are securely protected by the overhanging edges of the covers.

The resistances are of the cast-iron grid type. The individual grids are threaded on micanised steel rods, and are insulated from each other by mica washers. All connections are bolted. The easy accessibility of all parts will undoubtedly be appreciated by the men who have the handling and care of the gear.

Electrical Exhibition at Dordrecht.—H.M. Consul at Rotterdam (Mr. H. Turing) has forwarded a copy of a notice, issued by the Administrative authorities of the Department of Dordrecht, relating to an Electrical Exhibition to be held in the town of Dordrecht from April 30th to May 16th next, on the occasion of the forthcoming opening of the Dordrecht central generating station. The exhibition will embrace all materials and appliances connected with electricity for lighting, heating and industrial purposes. All articles intended for the exhibition will be allowed to enter duty free, with the proviso that they are not eventually sold in the country, and special facilities will be afforded by the Dutch railway companies as regards reduction of freight charges, &c. Exhibits must reach Dordrecht between April 15th and 25th, and must be installed before 6 p.m. on April 27th. Electric current will be supplied to exhibitors free of cost. Inquiries concerning this exhibition should be sent to the "Secretaris der Technische sub-Commissie der Tentoonstelling van Electriciteit, Steegoversloot 37," Dordrecht. Circulars (in Dutch) containing further particulars, may be seen by British firms interested on application at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*



G.E.C. Feeder Pillars for Capstan Control.

PROCEEDINGS OF INSTITUTIONS.

Losses off Transmission Lines due to Brush Discharge, with Special Reference to the Case of Direct Current.

By E. A. WATSON, M.Sc. (Eng.), Student.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *London, February 10th*, 1910.)

LEAVING aside economical considerations, there are three factors which limit the voltage which can be employed on a transmission line:—

1. The generating or transforming apparatus.
2. The line insulators.
3. Brush discharge off the line itself.

Of these, the third is the only one which will ultimately need to be considered, and is, at the present time, of considerable importance. Since it is beyond our power to increase the insulating power of air, unless a considerable change takes place in the present practice of line construction there will always be some voltage limit which it is not possible to exceed. It is proposed to consider this question in detail.

The question whether a discharge will take place off a wire or not seems to depend upon the value of the electric stress in the immediate neighbourhood of the wire. If this stress should exceed the electric strength of the air in which the wire is immersed, a discharge will occur. If the wire is sufficiently close to the other boundary of the field of force which produces the stress, the discharge will be actually disruptive, such as is given by a spark or arc. In the case of a transmission wire, however, this is not the case, and the discharge takes the form of a luminous envelope surrounding the wire, and is generally known as the corona. It produces a slight noise, and although only faintly luminous to the eye, gives off a powerfully actinic light, and can be readily photographed. In the following formulæ, let—

R represent the electric stress in kilovolts per centimetre;
a represent the radius of the wires in centimetres;
d represent the distance apart of the centres of the wires in centimetres;
h represent the height of the wires above the earth.

Then for two parallel wires indefinitely far from the earth, we have—

Maximum value of R at surface of wire—

$$= \frac{V}{2\ a\ \log_e d/a}\left(1+\frac{a}{d}\right) \text{ very nearly.}$$

where V is the voltage between the wires.

For one wire and earth we have—

$$R_{max} = \frac{V}{a\ \log_e 2\ h/a}\left(1+\frac{a}{2h}\right)^2 \text{ very nearly}$$

where V is the potential of the wire above earth.

For two wires not indefinitely far from the earth, we have—

$$R_{max} = \frac{V}{2\ a\ \log_e \dfrac{d}{a}\sqrt{1+(d/2h)^2}}\left(1+\frac{a}{d}\right)^2 \text{ very nearly.}$$

where $+\frac{V}{2}$ and $-\frac{V}{2}$ are the wire potentials relatively to the earth.

For a three-phase line arranged in the customary manner at the three corners of an equilateral triangle we have—

$$R_{max} = \frac{V}{a\ \log_e d/a\left\{1+(d/2h)^2\right\}^{-\frac{1}{2}}}\left\{1+\frac{\sqrt{3}}{2}\frac{a}{d}\right\}^2$$

very nearly, where V is the star voltage of the system.

These formulæ, it should be noted, are only strictly applicable when a is small compared to d—*i.e.*, as in the case of an ordinary transmission line.

For a wire in a concentric cylinder we have exactly—

$$R_{max} = \frac{V}{a\ \log_e b/a},$$

where V is the potential difference between wire and cylinder, and b the radius of the cylinder.

As soon as the corona forms it is a well-established fact that a large loss of energy will occur. It is, therefore, of importance to determine the value of the electric stress at which a corona will form and the effect of various conditions upon the value of this stress.

Most of the experimental work so far accomplished has been done in the United States, where the long distances and high voltages have emphasised the need for accurate knowledge of the subject.

None of the tests give a constant value for the electric strength (which theory would have us expect), but one which is greatest for the small wires and decreases rapidly at first as the wire size is increased, eventually tending, however, to a steady value for wires of 10 mm. diameter and over.

The exact manner in which the loss occurs cannot be said to be clearly understood.

It seems that when a direct-current brush discharge occurs the charge is not carried by the whole of the air which is in contact with the charged body, but by certain agglomerations of molecules which are driven off at a speed about 50 times as great as that with which the air as a whole would move. These charge carriers under certain circumstances drive the main body with them, forming the so-called electrical wind, but this wind is the effect rather than the cause of the loss of electricity from the conductor. It is believed also that in the case of an alternating-current corona most of the loss is due to this cause, and only a small amount to the energy stored in the broken-down air film or its resistance to the charging current flowing to its outer boundary.

At the Electrical Engineering Laboratories of the University of Liverpool during the months of May, June and July, 1909, experiments were made upon—

1. A wire in a concentric cylinder.
2. Two wires stretched parallel out of doors.

In the former case the wire was mounted at the centre of a cylinder of galvanised iron 6 ft. long and 8 in. in diameter. The ends were flanged and closed by cast-iron covers, and the pressure could be reduced to 350 mm. of mercury by means of a small motor-driven pump, fitted with automatic control so as to keep the pressure in the cylinder constant at any required value. The degree of humidity could also be varied.

Ebonite terminals were arranged in the ends; that at one merely supporting the end of the wire, that at the other serving to bring it out and make connection with it. In order to guard against any leakage occurring in the latter terminal, the wire passing through was protected by a concentric metal tube at the same potential, so connected that the current supplying it was not passed through the microammeter which measured the leakage off the wire.

Current was supplied by a special form of influence machine of large output driven by an electric motor, the machine being capable of working up to 70,000 volts. In order to have control over the output it was separately excited from an ordinary two-plate Wimshurst machine.

Across the terminals of the main generator was connected a condenser which served to keep the terminal voltage steady, and in the leads between the machine and apparatus resistances and inductances were arranged to prevent the existence of any voltage oscillations on the apparatus itself.

A 100,000-volt compressed-air voltmeter was connected across the apparatus, and a reflecting microammeter enclosed in a potential screen and mounted on a 75,000-volt insulator was placed in the lead to the wire under test, and as near to the end of the wire as possible. All connections were made of ⅜-in. brass tubing, in order to avoid brush discharges.

In the tests on the parallel wires a similar arrangement was adopted, the leakage over the insulators being collected and measured, and another voltmeter was employed connected between one wire and earth, in order to ensure that the two wires were equally positively and negatively charged.

In order to obtain higher pressures than could be given by the one machine a four-plate four-pole Wimshurst (giving the same current as an ordinary eight-plate machine), was arranged so that it could be put in series with the main generator.

The wires employed in the tests were 12 metres long, and were stretched at a distance of 1 metre centre to centre.

When the wire was positive under certain conditions, if viewed in a dark room, the space surrounding it for a distance of 1 or 2 cm. was full of fine branching bluish purple brushes darting about continually and never remaining stationary at one spot. Generally, however, when the current density was sufficient there developed on the wire a thin bluish-purple film which appeared to uniformly envelope it. A slight hissing noise accompanied the discharge.

When the wire was negative the film was absent, and its place was taken by a sort of halo of fine reddish-coloured discharges 3 to 5 mm. long going out practically radially from the wire; these discharges were very nearly stationary and much brighter than the corresponding positive ones, and were accompanied by a loud hissing noise which could be heard quite distinctly above the hum of the machinery in the room.

The positive corona seemed very little affected whether the wire were dirty or clean, but the negative one was very sensitive to the state of the surface. With the wire negative any small particles of dirt seemed to cause the discharge to concentrate itself upon it, each particle of dirt giving rise to a tuft of bright reddish light about 5 mm. long, which gave a strong wind; the discharge, moreover, was much less noisy, and if the wire were dirty enough, very nearly silent.

When the wire was quite clean both positive and negative coronas required very nearly the same voltage to start them.

There was, however, a difference once the corona was started in regard to the slope of the curve connecting voltage and current loss, the value of $d\,1/d\,V$ being greater when the wire was negative than when it was positive. When the wire was dirty, there was a great difference between the positive and negative conditions. With the wire positive the critical voltage was not much affected by the presence of dirt, but when it was negative discharge occurred at a much lower voltage; moreover, there was a great difference in the shape of the curve connecting current loss and voltage. The loss, instead of beginning sharply at some definite voltage, commenced slowly, and the curve gradually turned round so as to approach that for a perfectly clean wire. This is shown in fig. 1, which gives the curves obtained with a wire 1·85 mm. diameter both when clean and dirty. The similarity of the curve for the dirty wire to that of Mershon's Niagara tests is noteworthy.

Two things may be noticed from a general inspection of the results obtained: First, the increasing value of $d\,1/d\,V$ with the size of the wire; and secondly, the decreasing value of the critical electric stress.

The value of the electric stress, as found from the expression given above, showed a steady downward tendency, falling from 81·4 for the 0·70 mm. wire to 40·2 for the 9·53 mm. one.

It is stated by some authorities that the explanation of this apparent decrease of electric strength is to be found in the assumption of a constant potential drop occurring at the boundary of the wire, this being the same for all sizes.

It does not appear as if this explanation is a satisfactory one, and, to the author's mind, a far more reasonable one lies in the assumption that the layers of air near the wire or, in fact, near any conducting surface, have an electric strength greater than that

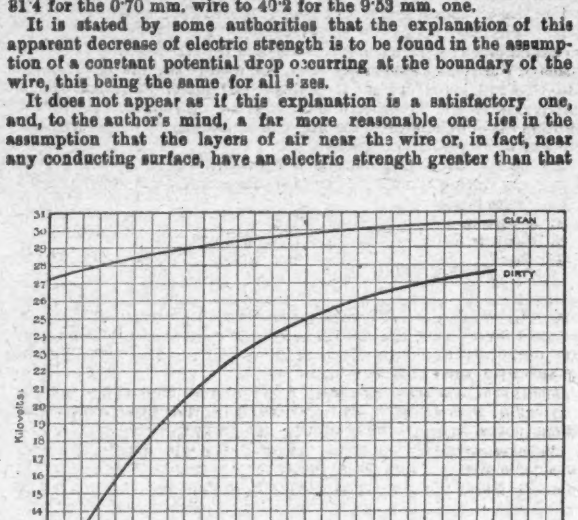


Fig. 1.—Comparison of Clean and Dirty Wires.

of the main body. This is an old idea, and has been suggested by Steinmetz, Ryan, and others. It will readily explain the high values of electric strength obtained with the small wires, as the thickness of the layer of electrically strong air is greater in proportion to a small wire than a large one. It is supported by the fact that the thin films formed in certain electrolytes, such as are used in electrolytic rectifiers and lightning arresters, are known to possess an abnormally high electric strength.

In fig. 2 are plotted the values of the electric strength of air deduced from these experiments against the diameter of the conductor employed. These agree very well indeed with Ryan's and

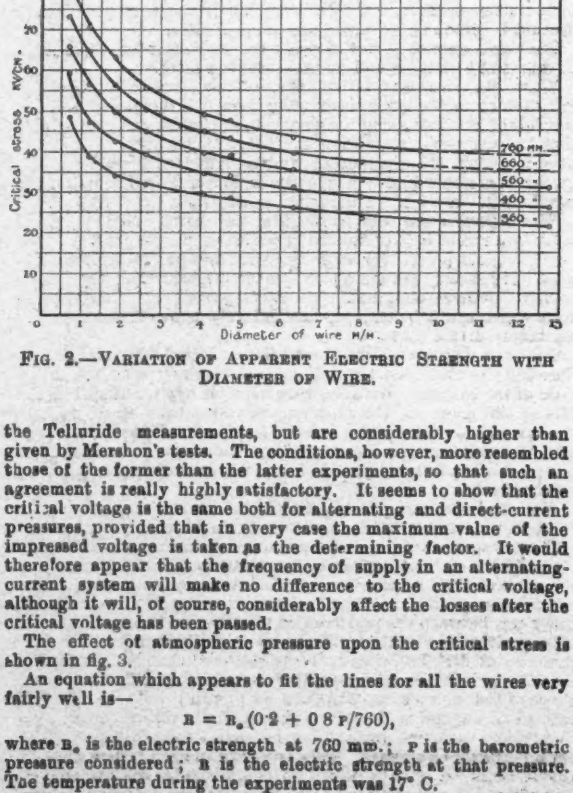


Fig. 2.—Variation of Apparent Electric Strength with Diameter of Wire.

the Telluride measurements, but are considerably higher than given by Mershon's tests. The conditions, however, more resembled those of the former than the latter experiments, so that such an agreement is really highly satisfactory. It seems to show that the critical voltage is the same both for alternating and direct-current pressures, provided that in every case the maximum value of the impressed voltage is taken as the determining factor. It would therefore appear that the frequency of supply in an alternating-current system will make no difference to the critical voltage, although it will, of course, considerably affect the losses after the critical voltage has been passed.

The effect of atmospheric pressure upon the critical stress is shown in fig. 3.

An equation which appears to fit the lines for all the wires very fairly well is—

$$B = B_0 (0{\cdot}2 + 0{\cdot}8\, p/760),$$

where B_0 is the electric strength at 760 mm.; p is the barometric pressure considered; B is the electric strength at that pressure. The temperature during the experiments was 17° C.

This result is rather higher than that obtained on a wire 0·125 in. diameter by Prof. Ryan, who obtains a straight line having the equation—

$$B = B_0 (0{\cdot}115 + 0{\cdot}885\, p/760).$$

This wire is, however, smaller than most of those used in the foregoing experiments.

The presence of water vapour had no effect upon the critical stress.

If these figures are to be applied to the case of an alternating-current line, it must be remembered that the voltages given are the maximum values, and must for that case be divided by the amplitude factor.

The tests which were made upon the two parallel wires hung out of doors were not as complete as those which were carried out on the wire and cylinder, as they were very much limited by the apparatus which was available, chiefly by the generator.

Tests could only be made on small-sized wires. Special attention should be paid to the test on the 0·70 mm. wire, as this is the most complete.

In fig. 4 two curves are given for the wire; the first was taken on a dry summer's day with very little water vapour present, the second on a day when a strong wind and driving rain were blowing in from the sea. It is probable that these two curves represent the extremes between which the losses lie for all ordinary country anywhere in the neighbourhood of towns or industrial centres.

The values of the critical stress given by the curves are considerably lower than those obtained from the tests of the wire in the

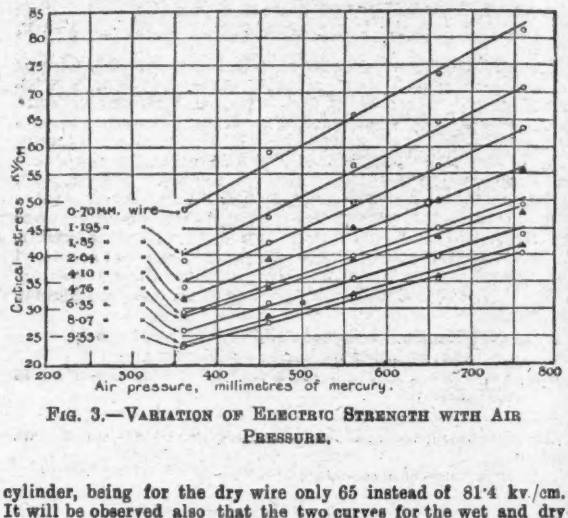


Fig. 3.—Variation of Electric Strength with Air Pressure.

cylinder, being for the dry wire only 65 instead of 81·4 kv/cm. It will be observed also that the two curves for the wet and dry wires, although starting at considerably different values, gradually approach one another and show a tendency to run together.

The explanation of these effects is believed to lie in the fact that the wire being dirty was not behaving in quite the same way as when tested in the cylinder.

Another peculiarity of these results is that the value of dv/di is much less than it was for the case of the wire in the cylinder—*i.e.*, a given increase of voltage above the critical one produced a much smaller increase in the value of the current lost per kilometre of line.

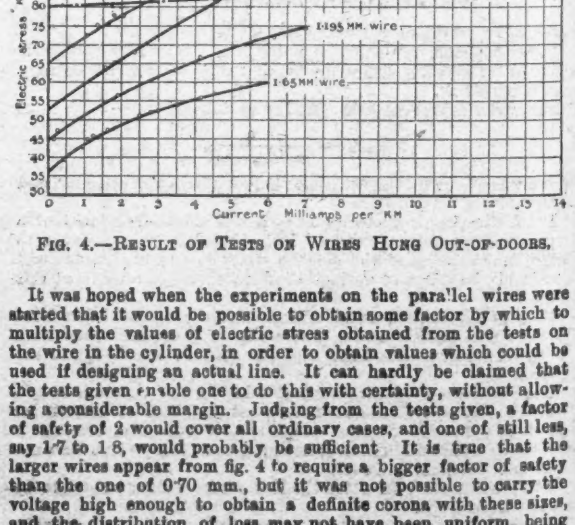


Fig. 4.—Result of Tests on Wires Hung Out-of-doors.

It was hoped when the experiments on the parallel wires were started that it would be possible to obtain some factor by which to multiply the values of electric stress obtained from the tests on the wire in the cylinder, in order to obtain values which could be used if designing an actual line. It can hardly be claimed that the tests given enable one to do this with certainty, without allowing a considerable margin. Judging from the tests given, a factor of safety of 2 would cover all ordinary cases, and one of still less, say 1·7 to 1·8, would probably be sufficient. It is true that the larger wires appear from fig. 4 to require a bigger factor of safety than the one of 0·70 mm., but it was not possible to carry the voltage high enough to obtain a definite corona with these sizes, and the distribution of loss may not have been uniform, being possibly greater at the ends (which were near to buildings) than in the middle. It is worthy of note that the ratios by which Ryan's

tests on the wire in the cylinder exceed Mershon's Niagara experiments vary from 1·73 for a wire 2·5 mm. diameter to 1·59 for one of 10 mm.

Summarising, there is a definite critical stress for which loss occurs from a D.C. line just as for an A.C. one, and the D.C. stress required to produce this loss is the same as the maximum A.C. one.

The critical stress is greater the smaller the wire diameter, and is reduced by reduction of the air pressure, but not proportionately; the presence of water vapour in the air does not affect the loss or critical stress for a clean wire.

An actual transmission line does not behave exactly like a perfectly clean wire, but a factor of safety varying from 1·5 to 2 should be allowed.

The loss which occurs with direct current when the critical stress is exceeded is due to the production of gaseous ions at the surface of the wire.

The writer expresses his thanks to the University of Liverpool for facilities for carrying out the work, and to Prof. E. W. Marchant for much advice and assistance during its progress.

Discussion.

Mr. J. S. Highfield said that he noticed that the author had not referred to the difficulty of getting sufficient amperes behind the volts in the D.C. tests; he appeared to have devised a good apparatus, particulars of which would be valuable if recorded. In practice, a D.C. line working with 75 amperes and 50,000 to 60,000 volts pressure between wires, and having some thousands of insulators, showed an almost negligible line loss. This was also the case with other long Continental D.C. transmissions. It appeared that the stress on an insulator with D.C. at 140,000 volts was the same as for an insulator with A.C. at 100,000 volts; he thought the tests on parallel wires ought to be carried further as being of more practical value.

Dr. A. Russell said the author's formulæ appeared to be substantially correct. The Telluride results referred to in the paper appeared low; they were carried out at a considerable altitude where the electric stress would be less, and it was curious that they were higher than the Niagara results. No doubt the corona followed the current as an arc would, and he thought it possible by suitable means to tell the frequency of a line from the discharge. One could not rely on tube experiments on account of the excessive ionisation, and he could not agree that the electric strength of the layer of air round the wire was stronger than the bulk; electric strength was something definite like resistivity. Ionisation accounted for the higher values of electric strength at the beginning of the curves (fig. 2) shown by the author. He thought the views of the negative and positive wires showed more ions leaving the negative than got into the positive wire.

Mr. E. H. Rayner described a modification of the test tube which gave better measuring results, and which he had recently used in very similar researches to those described by the author. The presence of dirt on a thin wire would tend to increase its diameter to a far greater extent than in the case of a thick wire. He had been experimenting to obtain the breakdown potential of air, and had used the tube method, obtaining results which agreed very well with those shown by the author.

Another speaker said Mershon had found a greater loss per unit length of aluminium as compared with copper wire, which might be influenced by the texture of the surface of the wire. Experimental results from wires of different metals would be valuable in this connection. It was just possible that the corona might influence the choice of aluminium or copper wire in a given case, as, owing to the larger diameter of aluminium wire for the same power transmitted, it might be outside the limiting factor of brush discharge.

Mr. H. M. Hobart said he was glad to see an agreement that the limiting factor of D.C. to A.C. was 140,000 : 100,000; it had been said that the ratio in favour of the Thury system as compared with A.C. was 2 : 1.

Mr. J. T. Irwin having shown some oscillographic records bearing on the working of an influence machine, the author briefly replied to the discussion.

Physical Society of London.

At the meeting held January 21st, 1910, a paper on "The Polarisation of Dielectrics in a Steady Field of Force," was read by Prof. Thornton. The paper contains an account of experiments on the polarisation of dielectric ellipsoids and cylinders suspended in a steady electric field. From measurements of the field-intensity, the dimensions of the ellipsoids, and the frequency of torsional swings with and without the field, the dielectric constant can be found from time to time. The method is essentially the same as that using alternating fields. From a comparison of the results of the paper and those in alternating fields, the variation of the dielectric constants with frequency can be anticipated.

Mr. Jacob said that some of the author's curves showed that he was dealing with dielectric hysteresis. The results for gutta-percha given in the paper could not be applied in telephonic work because of the high frequencies employed in the latter case. He pointed out that the field strengths used in the paper were much smaller than those occurring in actual work on cables.

Dr. Russell stated that the methods of measuring the dielectric coefficient and the insulativity of dielectrics were both novel and valuable. The subject was one of great practical and theoretical importance.

Mr. A. Campbell said that the results, which in themselves were highly interesting, were not directly applicable to telephone cables, since the frequency used with these was of the order of 1,000 cycles per second. In connection with the large polarisation shown by gutta-percha, he gave an example of a coil of gutta-percha-covered wire which gave an apparent insulation resistance of 200,000 megohms with direct current and one minute's electrification, but only a fraction of a megohm when tested at 1,000 cycles per second.

A paper on "The Use of Mutual Inductometers" was read by Mr. A. Campbell. In the use of mutual inductometers (or variable inductances) already described by the author, the use of a balancing coil in one arm of the bridge causes considerable loss of sensitivity. With an equal-arm bridge this difficulty is overcome by putting the two halves of the secondary circuit in adjacent arms of the bridge. The auxiliary balancing coil is thus dispensed with, and the usual formula is still applicable.

The author next discusses the measurement of effective resistance, which is in general much more troublesome than that of self-inductance. As the effective resistance determines the total power spent by a given alternating current in a conductor, it is a most important quantity in telephonic and other high-frequency work. When it is measured by an ordinary self-inductance bridge, Giebe has shown that large errors may be introduced by the small residual inductances of the ratio arms. The author works out the analogous formulæ for mutual inductance bridges, which indicate that the inductances of the ratio arms must be accurately proportional to their resistances, if errors are to be avoided.

He next describes a null method in iron testing analogous to Max Wien's self-inductance method. The ring to be tested is wound with primary and secondary coils. The magnetising current I_1 is passed through the primary coil, the primary circuit of a mutual inductometer and a slide-wire resistance. The detecting instrument, a vibration galvanometer or a tuned telephone, is put across a circuit consisting of the secondaries of the ring and the inductometer in opposition and a part Q of the slide-wire resistance. By adjusting Q and the reading M of the inductometer a balance is obtained, in which case the power lost in the ring (due to hysteresis and eddy currents) is equal to $Q I_1^2 \times F_1/F_2$ where F_1 and F_2 are the numbers of turns in the windings of the ring. In certain cases the permeability can also be directly found. The method is immediately applicable to the testing of current transformers.

Notes on Methods and Practice in the German Electrical Industry.

By L. J. Lepine and A. R. Stelling.

(Institution of Electrical Engineers; *Discussion at Birmingham, January 5th*, 1910.)

The chairman, Mr. R. K. Morcom, in opening the discussion, referred to the remarks made by the President at the London meeting. Prof. Kapp had warned them against the danger of dragging politics into their discussions, but he thought it was very difficult to define any exact boundary. One thing was certain, and that was that electrical engineering was influenced by other considerations besides purely scientific ones. Whatever branch of engineering they happened to be employed upon, they must, sooner or later, come down to sordid commercialism and undignified politics, and endeavour to see eye to eye with the manufacturer and the financier. In addition to such abstruse considerations as periodicity and forms of winding, their discussions must take into account such matters as the ability of the staff and workmen, cost of raw materials, factory organisation, magnitude of the market and the laws and regulations binding the individual, the factory, the supply company, and the country itself, and even the fiscal conditions of that country. The price of the metal for a conductor was quite as important as its conductivity, and it was as important to the designer to know whether a piece of apparatus could be properly sold, as it was to be satisfied that it would give the results for which it was intended. Turning to the paper itself, Mr. Morcom said that the German banks were larger than the banks in this country, but there were fewer of them. That might not be regarded as a disadvantage. The German banks were undoubtedly more speculative than the English, but there were two sides to that question. For instance, the collapse of the Dresden and Leipsic banks seriously upset the industry, but the crash afforded the opportunity for merging the industry into a few large concerns, the prosperity of which was referred to in the paper. He noticed from a balance-sheet of the Allgemeine Elektricitäts Gesellschaft that the kilowatt output per workman was not so much as in this country, which probably meant that the British workman was the more efficient man. It was stated that one great advantage of the large capital was the ability to meet sudden demands, such as that for special plant for the construction of large turbo-generators. But he found that when one was trying to get quotations for turbo-dynamos in this country there was no difficulty at all. The British firm would always give a quotation, even if it had never made a turbo-generator before. As to bureaucratic rule in the office, no doubt there was a danger of red tape, but the beautiful schemes drawn up by works managers and their head clerks did not work in Germany any more than they did in this country. The procedure in regard to the foreign department described in the paper was by no means rare in British factories. His own firm had a special department not only for foreign trade as a whole, but also for each of the large countries in which they had agents. As for Mr. Lepine's desire to encourage the growth of a larger body of technical experts in this country, salaries of experts were kept low

even in Germany. In his own office they could not get anybody, let alone a chief designer, at the wage a chief designer got in Germany. As for the subsidiary companies which were so common in Germany, he thought it was merely a matter of book-keeping. For instance, in his factory the foundry was treated as a complete concern and sold its output to the other factory, keeping a separate set of books, the returns of which were added up in the total. The statement that English firms rarely troubled to send experts to investigate proposed schemes was really too sweeping. In different parts of the world his firm had a number of their best men, whose sole work it was to go over different places where they had installations, and examine them to see whether they were satisfactory. Everyone of them could say what screw was required, and the place in which it should be fitted, as well as any German could. He did not know what was the authors' authority for their statement about direct-current turbo-generators, but the Allgemeine Elektricitäts Gesellschaft reported in 1906 that they had had a large number of orders for 3,000-KW. continuous-current turbo-generators. He did not think that an order for continuous-current turbo-generators of that size had been executed in this country at all.

MR. ORSETTICH said that he had spent many years in Germany. It appeared to him that the authors' observations were somewhat superficial. The explanation of the results obtained in Germany, and of the advantages which the German was said to have over the British manufacturer, seemed to him not to be the real one. He believed that a great deal of the influence which the banks had had on the industrial system of Germany, was due primarily to the law as to the constitution of public companies. In order to prevent undue competition and gambling, no shares of public companies could be issued for a less value than £50, and as a consequence there was hardly any public market for shares in Germany. The man who owned only a small capital could not invest it in shares, but must put it into the Post Office or industrial banks. These banks were the respositories of the savings of the country, and whenever a manufacturer wished to borrow money, he went to the bank instead of issuing shares to the general public as was done in this country. This gave the banks the duty of supervising the investments in most of the German industrial companies. The banks became the centre of the German industrial world, and in the interests of their customers endeavoured to ensure the companies being fully employed, and to prevent ruinous competition among them. The German system had a very good effect, because the schemes promoted by any company had to be investigated by the banking companies, who would appoint either consulting engineers or financial investigators to prove whether a scheme was unsound, or whether there was any hope of successful development. The investor, on the other hand, had a security that his own interests were safeguarded to a very great extent, so that there was very much more confidence in placing his capital in the bank for the exploitation of those particular works. It was mentioned in the paper that the most important reason for the present success of the German electrical industry was their practice in regard to designing and their system of production. He did not see that these had very much bearing upon the conditions prevailing in this country at the present moment. The crisis during the last three years was due to over-production, and the conditions of this country were such that an increase of production which would be brought about by applying the system described in the paper, would have the opposite effect to what was expected by the authors. The only cure for the present conditions was restriction of production and amalgamation of concerns. With regard to the large technical staffs employed, highly trained technical men were being turned out there at the rate of some 3,000 a year, and naturally the price of the individual was low. This was very satisfactory from the point of view of the manufacturer, because he could keep a highly trained staff at a low expense and use them for all sorts of secondary purposes in the works. The number of uses to which an engineer was put in Germany was almost incredible. He was used for supervising small departments and positions which in this country would be filled by ordinary clerks or workmen. This might be good for the industry, but it was a very poor outlook for the men. The statement in the paper that all engineers passed through the drawing office was, he believed, rather incorrect. With regard to draughtsmen not being allowed in the shops, there was no more difficulty in Germany than in this country in a draughtsman getting a ticket to go into the shop, unless there happened to be some secret job on hand. A great point was the systematic way in which things were done. Everything was dealt with in committees, and well thrashed out, while there was also an advantage in having the services of so many well-trained specialists. The last point which struck him was the attention given to scientific work and the maintaining of important departments for investigation. One of the most striking results of this was that during the crisis of 1901, whilst practically every firm reduced its expenses in all other departments, no reduction was made in the amount devoted to scientific investigation.

MR. MOFFATT was in favour of working agreements between the various firms on the lines which had proved so advantageous in Germany, and which had been arrived at, to some extent, by the railway companies and motor firms. With regard also to the influence of the association with the banks in promoting the electrical industry, he knew of a case in Africa where, although a concession for lighting had been obtained and sufficient payment guaranteed by the Government to pay 5 per cent. on the outlay, no English capitalist would come forward, and they had had to go to a German firm. It was not the engineers who were at fault in this country, but the backing which they got, or, rather, did not get. The 18-hour day, while it undoubtedly would lessen cost of production, would hardly commend itself to the employés, especially as only a quarter of an hour was allowed for meals. He thought, also, that owing possibly to their excessive specialisation, German manufacturers were very arbitrary in their designs and methods, and he had had considerable difficulty in getting German apparatus made to satisfy his particular requirements and specifications.

MR. S. P. SMITH did not know whether the system in regard to banks outlined in the paper could be adopted in this country. It was, however, rather a political question. He thought that the result of it was that the German firms could to a certain extent do what they liked, and instanced a case when, on the Government imposing a tax on electricity, the manufacturers had asked their customers to withhold their large orders with a view to influencing the Government. Another result of these arrangements between firms and banks was that the plants put down were carried out on a far more elaborate scale than was the case in this country. When he was in Germany as a research student, he was greatly struck with the number of technical men they were turning out. Their lot, however, seemed to be a hard one, and there was little doubt but that they were rather overdoing it. The average age of a man entering the works was much higher than in this country, and the pay was very poor; in fact, he thought that the £6 5s. mentioned in the paper would be challenged, and that 80s. would be nearer the mark. Last May he had received five or six letters from technical men in Germany, asking whether there was a chance of getting a start in England. With regard to English and German designing, he thought that if anything the English was superior, and that the English technical training was very hard to beat. The Germans had so little competition to fear that it did not matter whether their machines were all that was to be desired or not. The customer had to take them.

DR. GARBARD said that he had lived some years in Germany, and it appeared to him that the great difference between the Germans and the English was the German devotion to scientific experiment. They believed in science, and also in paying for it and developing it, and it was his firm conviction that their progress was due to that.

MR. LEPINE, in reply, said that specialisation was carried to such an extent in Germany that a man was made into a machine. He was conversant only with his own work, and would know nothing of that of the man working next to him. In connection with subsidiary companies which were formed for the sake of obtaining a big output, he considered that they had a great advantage in that they took a name suitable to the country in which they happened to be, and also that they were able to deal in terms best understood by that country. The chairman had remarked on the advantages of having representatives abroad. While this might be possible for a firm of engine builders, it was not so in the electrical trade, which was not so well furnished with funds. But he suggested that a good deal could be done if different firms could work together and combine to have a representative in places where it would not pay a single firm to support one. In important centres they could combine to keep a complete staff ready to design a power station and furnish complete schemes. German shops were likely to be well looked after, if only for the reason that they were newer than English shops. The difference in regard to the ventilation and setting-out of the shops was very marked. He also considered that the Germans adapted their designs better to suit their machines. With regard to the question of capital, he reminded the meeting that Mr. Stelling, in the London discussion, had pointed out very clearly that the reason why the capitalist came in rather than the small investor, was on account of the £50 share. As regards amalgamation, there did not seem at the present moment to be any financiers in this country who were prepared to buy up the whole of the electrical manufacturing firms, and this, he thought, was the only way in which amalgamation would be found possible. He considered that the main reason why German machinery was coming into this country at figures so much below those at which the British maker could sell, was largely because of the three-shift system, which enabled them to considerably reduce their working expenses. The changing round of shifts was done at the week ends. Their figure for the wages received by engineers had been criticised, and he pointed out that Mr. Wilson, when speaking in Manchester, had confirmed their figure.

PROF. KAPP, in proposing a vote of thanks, said that he got letters from old students asking whether he could not get some job for them in England; they found it hard to get anything in Germany. There was actually an over-production of scientific men in Germany, and although some firms employed a greater proportion of black-coated workmen than of workmen in overalls, there was not work for all. They had to work for low wages, and if a man could get £6 5s. a month, as the authors asserted, he was lucky. The three-shift system was a new departure which had not been introduced when he was in Germany.

Rail-Welding Contracts.—MESSRS. THERMIT, LTD., inform us that in addition to the work on the York tramways, which will shortly be completed, they have welding contracts in hand for Wallasey U.D.C. Tramways; Bolton Corporation Tramways; Metropolitan Electric Tramways (per Dick, Kerr & Co., Ltd.); L.C.C. Woolwich to Eltham Tramways (per A. Stark and Sons); and Gateshead Tramways (per W. Griffiths & Co., Ltd.). The Thermit joint has also been specified for the Linthwaite U.D.C. Tramways (Huddersfield) and the Whitworth U.D.C. Tramways. In addition to these, Birmingham, Manchester, Leeds, Bristol, and many other systems are carrying out welding with their own staffs.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

A New "Tricity" Oven.

From the Berry Construction Co., Ltd., Charing Cross House, London, W.C., we have received advance copies of a new leaflet (No. 12) which is being issued this week, illustrating their "Tricity" electric cooking outfits, in the prices of which they have made considerable reductions, bringing them within the means of many

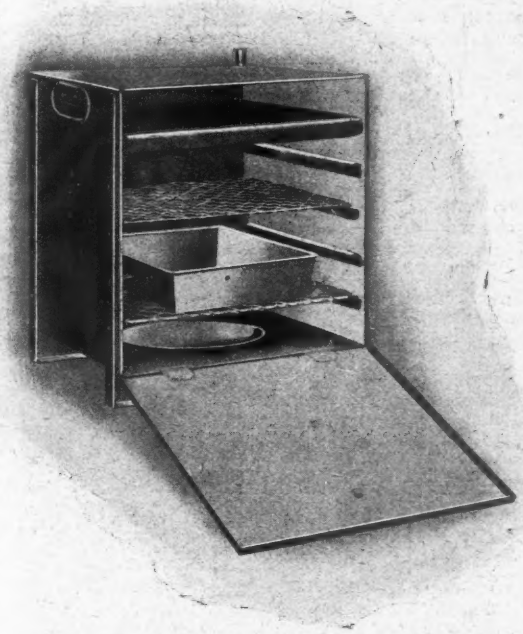


Fig. 1.—The "Tricity" Oven.

who at present regard the cost of an electric cooking installation as prohibitive. The firm have also introduced a new feature in the "Tricity" oven, which, when placed on a cooker already hot, taking from 800 to 900 watts, attains a working temperature of 300° F. in five to seven minutes. The oven, which is shown in the accompanying figure, is listed at a very low figure, with two removable shelves, baking tin and deflector. Cheapness and durability are the claims made for the apparatus.

New Adapter.

The distributing engineer of the Metropolitan Electric Supply Co., Ltd., has devised a new adapter to enable small apparatus such as irons, kettles, &c., to be connected to an ordinary lamp-holder without putting the lamp out of use, while at the same time it meets one of the new requirements of the Fire Insurance Companies, namely, that whenever an iron or such apparatus is used, there

Fig. 2.—New Adapter.

should be some indication that the current is on the apparatus. This is accomplished by the adapter, owing to its being possible for the lamp to be in use at the same time as the iron.

With many of the adapters on the market, it is necessary to remove any shade that may be in use before the adapter can be applied; if an adapter is put above the shade, the flexible which is carried away for the iron or other apparatus is apt to cause the tilting of the shade. These drawbacks are avoided in the adapter illustrated in fig. 2.

There are many other useful purposes which this adapter serves; for instance, a connection for table decorations can easily be made from an existing light above.

Arrangements have been made with several of the large supply houses for the placing of the adapter on the market.

"Victor" Miniature D.C. Arc Lamps.

The Electric and Ordnance Accessories Co., Ltd., of Cheston Road, Aston, Birmingham, have recently modified the design of their miniature Victor enclosed arc lamps, the new designs being recommended for use indoors in place of high candle-power glow lamps, as being far cheaper in upkeep. Two of these, of the "bayonet" pattern, are illustrated in the accompanying figures, taking 2½ amperes on 100 to 125 volts, or 1½ amperes on 200 to 250 volts; or two may run in series on 200 to 250 volts,

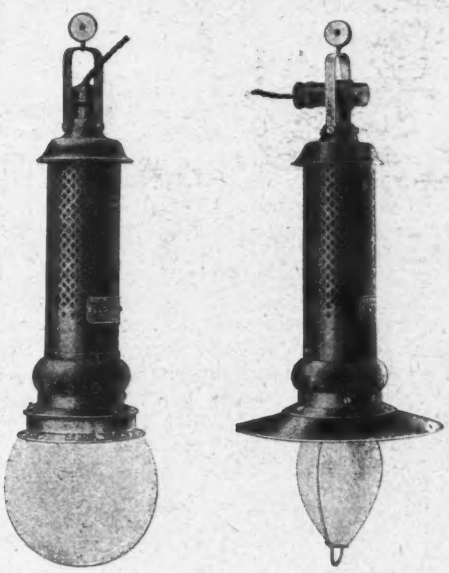


Fig. 3. Fig. 4.

"Victor" Miniature Arc Lamps.

taking 2½ amperes. The burning hours are 25 to 35, with one pair of carbons; the length over all is 16 in., and the weight 4 lb. Fig. 3 is double enclosed, fig. 4 single. A special porcelain adapter and plug are used for making the connection with the lighting circuit, which, in view of the small current, need not be larger than for incandescent lamps.

These lamps, in addition to the firm's standard enclosed arc lamps, and flame arc lamps, accessories, &c., are described and illustrated in a new catalogue (A 43) recently issued.

High-Pressure Blow-off Valve.

A new blow-off valve, designed and patented by Mr. Patterson, and sold by Messrs. Wallach Bros., Ltd., Finsbury Square, E.C., is shown in fig. 5, with the interior exposed to view. It is a full-way valve of strong and simple construction, the valve being a faced disk which slides over a seating, and is actuated by an arm which can be operated from outside the casing. The faced disk

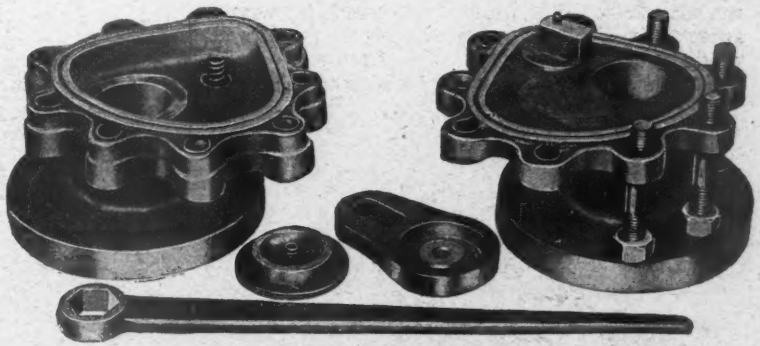


Fig. 5.—Parts of High-Pressure Blow-off Valve.

fits into a recess in the arm, and is held against the seating by a small spring; disk and arm are shown separately in the figure. The spindle which actuates the arm is provided with a special steam-tight seat, upon which it is pressed by a spring. The valve disk is never exposed to corrosion or the access of grit, being applied to an extension of the working face when open. The valve is tested under 250 lb. per sq. inch, and is readily opened under pressure without effort.

The "Dreadnought" D.P. Switch-Fuse.

The accompanying illustration shows a new patent switch-fuse designed by Messrs. Berry, Skinner & Co., of 78, Upper Thames Street, E.C., for the Admiralty, and approved by the latter. As will be seen, it is enclosed in a substantial cast-iron case, which is quite watertight when closed, the leads and handle entering through stuffing-boxes. In accordance with Admiralty requirements, the construction is of mica and metal throughout, and the insulation resistance is extremely high. The switch is positively locked when either off or on, so as to withstand vibration due to gunfire, and is provided with both quick make and quick break, no intermediate position being possible. It is impossible to open the

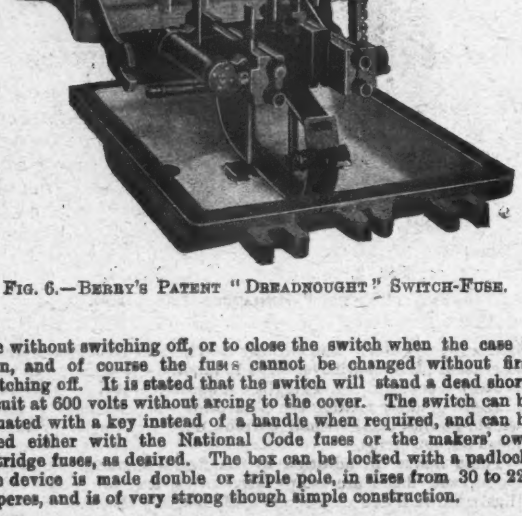


Fig. 6.—Berry's Patent "Dreadnought" Switch-Fuse.

case without switching off, or to close the switch when the case is open, and of course the fuses cannot be changed without first switching off. It is stated that the switch will stand a dead short-circuit at 600 volts without arcing to the cover. The switch can be actuated with a key instead of a handle when required, and can be fitted either with the National Code fuses or the makers' own cartridge fuses, as desired. The box can be locked with a padlock. The device is made double or triple pole, in sizes from 30 to 225 amperes, and is of very strong though simple construction.

Grooving Machine for Trolley Wire.

The accompanying illustration shows the latest pattern of Mr. Barnes Kay's improved grooving and flanging machine, which enables ordinary mechanical ears to be fixed on a round trolley wire. The system has recently been subjected to a severe test; the line became loose at its carrying points (on the Haslingden Corporation tramways), but after it had broken loose at several

Fig. 7.—Grooving Machine.

poles, it was checked both ways and prevented from going any further by ears fixed on this method, though the strain was so severe that it bent the carrying arm. The machine is easily operated with rack and pinion gear, and six complete turns with the handles make grooves long enough for a 15-in. ear. The machine is supplied by the inventor at 262, Blackburn Road, Haslingden, Lancs.

CAST-IRON FITTINGS FOR SUPERHEATED STEAM.

The *Journal* of the American Society of Mechanical Engineers recently contained three papers on this important question. Very properly a suspicion of cast-iron as a material for high-temperature steam containers of any sort has grown up from the numerous failures of cast-iron fittings for superheated steam. Prof. Hollis, of Boston, however, holds a brief for cast-iron, and advances figures which he considers show that high temperature does not injure cast-iron, but that failures result from other causes. Of course, if the expansion of cast-iron becomes greater as the temperature becomes greater, there must be greater stresses set up, and cast-iron fittings will fail which would not fail with half the stress. This is obvious, of course, but we can hardly take it to prove the case for the cast-iron fitting. If a fitting fails it fails, and is not suitable. If the same fitting of steel does not fail, then the steel is suitable. Let us, however, give some of the professor's facts, for other writers hold various views for and against cast-iron. He starts out with the temperature of 550° to 600° F. before his mind in cases of failures of fittings on *long* mains. Thus at once is brought in the question of design. A main for very hot steam has no business to be long. It must have means of expansion. What is actually known of cast-iron when exposed to very hot steam, is that a few months of service have developed cracks and small changes of shape. A temperature of 500° F. has produced permanent increase of dimensions.

Test pieces from fittings that have failed show in some cases that permanent loss of strength has taken place, but it is argued that though test pieces show great irregularity when cut from fittings that have been a year exposed to a temperature of 550° to 600° F., yet there is no proof of any better results from new fittings. It may all be a matter of the casting.

The fittings in the South Boston (U.S.A.) station showed after being in use a year on a long main, certain cracks in a fitting tee of 8 in. × 6 in. × 6 in. size. Another failed in 14 months. Yet of six test pieces four showed over 26,000 lb. per sq. in., and two showed under 15,000 lb. But all had, of course, been equally hot. Four tests from a larger T showed each over 23,000 lb. An 8 on 14 tee was tested hydraulically after exposure to 578° F. for 15 months. It stood 1,650 lb. before bursting. A 6 in. on 8 in. tee stood 3,100 lb. pressure.

A number of other figures of tests are given, and the general conclusion drawn is that while it is wise to use steel where expansion stresses are great, the troubles experienced are not due to deterioration of the cast-iron by temperature, but are incidental to the design. It is also cheaper to put in steel fittings than to put in expansion or slip joints.

In Mr. Miller's experiments regular test pieces were made, and one of each pair was exposed to superheated steam. This avoided the uncertainty of test pieces cut from oddly-shaped castings.

The steam pressure applied was about 93 lb., and the temperature was 660° F. rising to 720°. It was intermittent, the tests ceasing at night so far as regards the superheat. The exposure was to superheat 260 hours—saturated 460 hours. Other tests were made similarly, but with an average superheat of 390° F. Some of the test pieces were of semi-steel made by adding 200 lb. of steel to a 1,500-lb. ladle of cast-iron.

Two cast-irons on an average showed a loss of strength of 9·5 and 2·4 per cent. Gun-iron lost 2·1 and 3·5 per cent. Semi-steel only lost about 0·4 per cent. Rolled steels of 65 to 100,000 lb. tenacity lost under 2 per cent. up to 90,000 quality. The 100,000 quality lost 24 per cent.

Tests are quoted showing 41 per cent. loss in pieces cut from a valve heated to 590° for four years. But this may be a matter of the position of the test piece, and the comparison is only made with the coupons tested when the valve was made.

Mr. Mann in the third paper refers to the growth of cast-iron by repeated heatings, and concludes generally that cast-iron is not suited for superheated steam fittings. He also refers to the failure of steel fittings when carrying superheated steam. Steel gate valves yielded badly in the bodies. He does not consider that superheated steam will initiate defects, but it will find out and develop them if latent. He then proceeds to state that gun-iron is the proper material to use, that is, a cast-iron of 30,000 lb. tenacity, with low silicon, low phosphorus and low carbon. An iron successful for four years with a superheat of 300° had the following analysis:—Silicon, 1·72; sulphur, 0·085; phosphorus, 0·89; manganese, 0·48; total carbon, 2·45; and combined carbon, 0·17 per cent. This is the mixture in a valve of 8 in. which is still tight.

Such irons can be got, it is claimed, easily. Chemical tests are so easy to get. One can so readily take a drilling test and save the piece, whereas a test bar implies the ruin of the piece.

There is thus still something to be said for cast-iron fittings even for large pipes, but the main danger arises from the expansion of long unrelieved lengths of pipe, not to name water hammer, the shock of which may so easily destroy a piece already under heavy stress.

And when great stresses are liable to be generated, as they are liable with high superheat and abnormal linear expansion, it is to be feared that too much may be made of the possible satisfactory chemical analysis that ought to be assured in pipe iron. It is, unfortunately, true that wide ranges of temperature are a feature in most superheating practice, and there probably is a danger in rapid temperature variation. It seems rational to suspect it of starting microscopic surface cracks which may develop into serious defects

and the extreme variation in the estimate of different engineers as to the behaviour of cast-iron justifies caution in putting it to the most strenuous duty. Chemical foundry work is none so common that the engineer can feel safe in relying on analysis for the safety of his pipe system.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NEWFOUNDLAND (*concluded*).

In the case of goods consigned to a person, firm, or corporation other than the actual owners of the goods, resident in Newfoundland, and in the case of goods which have not actually been purchased by the consignee or importer in the ordinary mode of bargain and sale, or where purchased through an agent, there must be annexed to the invoice of such a declaration to be made by the foreign owner or exporter of the goods in the following form approved by the Governor-in-Council.

Declaration prescribed for invoices of merchandise sold to importers in Newfoundland and exported thereto, to be signed by a partner, official or employé of the exporter having a knowledge of the facts certified to and to be written, printed, or stamped on the face or back of the invoice:—

I, the undersigned, do hereby certify as follows:—

1. That I am the exporter of the goods in the within invoice mentioned or described.

2. That the said invoice is in all respects correct and true.

3. That the said invoice contains a full and true statement showing the price actually paid or to be paid for the said goods, the actual quantity thereof, and all charges thereon.

4. That the said invoice also exhibits the fair market value of the said goods at the time and place of the direct exportation to Newfoundland, and as when sold at the same time and place in like quantity and condition for home consumption, in the principal markets of the country whence exported directly to Newfoundland, without any discount or deduction for cash, or on account of any drawback or bounty, or on account of any royalty actually payable thereon, or payable thereon when sold for home consumption but not payable when exported, or on account of the exportation thereof or for any special consideration whatever.

5. That no different invoice of the goods mentioned in said invoice has been or will be furnished to any one; and

6. That no arrangement or understanding affecting the purchase price of the said goods has been or will be made or entered into between the said exporter and purchaser or by anyone on behalf of either of them, either by way of discount, rebate, salary, compensation, or in any manner whatsoever than is shown in the said invoice.

Dated at
19 .

Exporter.

When goods are imported into this colony from any country other than Great Britain, Ireland, or Canada, the invoices thereof must show the cost of inland transportation, shipment, and transhipment, with all the expenses included, from the place of growth, production, or manufacture, whether by land or water, to the vessel in which shipment is made, either in transit or direct to this colony.

Whenever any duty *ad valorem* is imposed on any goods imported into the colony, the value for duty is taken to be the fair market value thereof when sold for home consumption in the principal markets of the country whence and at the time when the same were *exported* directly to the colony. The market value is to be the fair market value of the goods in the usual and ordinary commercial acceptation of the term at the usual and ordinary credit, and not the cash value of such goods, except in cases in which the article imported is by universal usage considered and known to be a cash article, and so *bona fide* paid for in all transactions in relation to such article; all invoices representing cash values, except in the special cases herein referred to are subject to such additions, as to the collector or appraiser at the port at which they are presented appear just and reasonable, to bring up the amount to the true and fair market value. The following goods are admitted duty free:—Articles imported by or for the use of the Government and any of the departments thereof; articles imported for the use of municipal councils; articles, viz., all construction materials and machinery for pulp and paper mills imported by the Anglo Development Co., Ltd., for original installation and further extension, but not in substitution for old; scientific instruments and apparatus for use in colleges, scientific societies, &c.; mining machinery generally.

The following duties are payable:—

Glass and glassware, except common colourless window glass	40 % ad val.
Brass and copper wire, plain, tinned or plated	35 % „
Brass and copper wares	35 % „
Wire and wire rope of various kinds	35 % „
Electric motors	25 % „
Telegraphic or telephonic instruments; electric or galvanic batteries when not imported by doctors	35 % „
Electric light machinery and electric material of every description, including carbons, electric meters and electric apparatus	35 % „

[The Postmaster-General has the exclusive privilege of erecting and maintaining telegraph lines and of transmitting telegrams and other communications by electricity within the Colony, with certain exceptions respecting railway lines (Act No. 14 of 1904).]

The Government has entered into an agreement with the Marconi Wireless Telegraph Co. whereby the company has the right to establish and maintain for a period of 10 years, from September, 1903, the only wireless telegraph system in the Colony or Labrador (Act No. 9 of 1906).

Lamps, chandeliers, &c.	35 % ad val.
Shades and shade holders	35 % „
India-rubber and gutta-percha manufactures	40 % „
Structural work of iron or steel	20 % „
Galvanised sheet-iron manufactures	45 % „
Boiler tubes of wrought-iron or steel	10 % „
Railway bars or rails of any form, whether punched or not, fish-plates, switches, frogs, crossings and intersections	30 % „
Locomotives, railway and tramcars of all descriptions	30 % „
Water wheels	10 % „
Power machines for use in the manufacture of steam and other engines and boilers; gas engines; steam engines to be used in local industries	25 % „
Steam boilers for power purposes	25 % „
Machinery for use in ships	25 % „
Radiators, fan-blowers, elevators, fanning mills, horse-power machines, also dating, paging and perforating machines	35 % „
All other machinery not separately mentioned in the tariff:—	
If patented, and of a kind not manufactured in the Colony	25 % „
Otherwise	35 % „
Goods not specially mentioned in the tariff	40 % „

THE JAPAN-BRITISH EXHIBITION.

We have so often pleaded for the hearty co-operation of English industrial manufacturers and English engineers, in order to make our country's section of the Japan-British Exhibition worthy of the wonderful exhibits which our allies are now busily engaged in arranging at the "White City," that it seems idle to further labour the topic in our pages. We can only express the pious hope that the function held on Monday evening last at the Hotel Cecil, with the Duke of Norfolk, as President of the Japan-British Exhibition, in the chair, may bring about the much-to-be-desired consummation. Upwards of 400 guests accepted the invitation to the dinner of the Exhibition Council. His Excellency, the Japanese Ambassador, occupied the seat of honour on the chairman's right, while on his left was Mr. H. Wada, the Commissioner-General. With him were the other Commissioners—Count Mutsu, Mr. U. Beppu, and Mr. N. Kanyaki.

After the toasts of "The King," and "The Emperor of Japan" had been honoured, the Duke of Norfolk, in proposing "His Excellency the Japanese Ambassador and Prosperity to the Commercial Relations between the two Island Empires," claimed that that remarkable gathering of distinguished men showed how keen was the interest that was being felt by the people of this country, and by the great City of London, in the gathering together of Japan and Great Britain, and the interest, he ventured to believe, was steadily growing as the great project in which they were concerned became more widely and generally known. He had heard that night that the Admiralty and other Government departments were eager to take their share in helping forward the Exhibition, and on every hand deep, broad-based, and intelligent interest was being shown in the undertaking. In supporting the Exhibition they believed that they were promoting the commercial well-being of the two nations, and they extented a hearty welcome to Mr. H. Wada, the Commissioner-General of the Japanese Government.

The Japanese Ambassador said that the friendliness and cordiality of the relations between the United Kingdom and Japan left nothing to be desired at the present moment. It was the desire of his Government, and he trusted it was the wish of his Majesty's Government, to maintain this happy state of affairs, and to augment the commercial and other relations, in which there was still ample room for further development. In taking up such an important part in the forthcoming Japanese Exhibition as it had decided to do, the Government of his country thought of the good results which would ensue, to an appreciable extent, if the scheme of the Exhibition was well and successfully carried through. With this object in view, it was doing its best to contribute to the success of the undertaking as far as lay in its power, and the whole Japanese nation had approved of the measures adopted by the Government, both by word and deed. He had no doubt that it would be the great attraction of the coming London season, but they must not be content to have an attractive show which left no traces behind. It was with a much more serious object that they were concerned—the bringing closer together of the two island Empires, and the securing to them both benefits of a moral, material and intellectual character. The Exhibition was a great

undertaking, and no effort should be spared on either side to ensure its complete success.

At the instance of the Lord Mayor, the company drank with great heartiness the toast of "Welcome to Mr. Hikojiro Wada." Speeches in its support were delivered by Mr. T. McKinnon Wood, M.P. (Under Secretary of State for Foreign Affairs), Sir Melvill Beachcroft (chairman of the London Council), Mr. Imié Kiralfy, Mr. W. Fowler, and Sir Boverton Redwood.

Mr. H. Wada, in responding—and it is interesting to note that this was his first speech delivered in the English tongue—said they could hardly realise the enthusiasm with which the Japanese Government and people had entered into the idea of holding a great exhibition in London. As an effective means of giving an impetus to industrial enterprise, and of developing the natural resources of the country, the Japanese Government had from time to time held exhibitions. An industrial exhibition of national importance took place every five years in one of the principal cities of the Empire, as well as smaller ones of less significance every three years in different parts of the country. But, as soon as the Japan-British Exhibition was decided upon, they set aside their local and individual interests and at once devoted themselves to the task of doing their utmost to render the nation's exhibits in England a great success. Not only manufacturers and firms, but public institutions, as well as the Government, had taken such interest in this coming enterprise that they firmly determined at the outset to display something quite on different lines to anything that had hitherto been attempted either at home or abroad, and he ventured to hope that their efforts had not altogether been in vain.

But nothing, in our opinion, was said during the evening which could be at all compared, so far as real information is concerned, with the admirable lecture delivered before the Society of Arts last month by Count Mutsu, and to which we referred at considerable length in our leading columns of January 28th. To that issue of the REVIEW, and to our leader of November 12th last, we would again draw the attention of those firms who have either declined to exhibit or who are still undecided. *Noblesse oblige!*

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

2,349. "Improvements in telegraphic relays." I. KITSEE. January 31st (Complete.)

2,350. "Improvement in cable telegraphy." I. KITSEE. January 31st Complete.)

2,352. "Improvements in or relating to apparatus for working electric arc or the like lamps in series." A. HEIMANN and W. SCHAFFER. (Date applied for under Sec. 91 of the Act, February 1st, 1909, being date of application in Germany.) January 31st. (Complete.)

2,364. "Improvements in and relating to the arrangement of electrodes for the electrolytic refining of metals." F. M. KOHLER. January 31st.

2,408. "Improvements in receivers for wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH CO., LTD., and C. S. FRANKLIN. January 31st.

2,410. "Improvements in and relating to electro-magnets." R. W. JAMES. (Compagnie Generale de Phonographes Cinematographes et Appareils de Precision, France.) January 31st. (Complete.)

2,422. "Improvements in telephone cords." T. H. M. HARVEY. January 31st.

2,423. "Improvements relating to electro-magnets." H. R. SCHULTZ. January 31st.

2,432. "Improved means for checking the use of electric current consuming apparatus, and more particularly of electric glow lamps." FELTEN & GUILLEAUME LAHMEYER-WERKE AKT.-GES. (Date applied for under Sec. 91 of the Act, February 1st, 1909, being date of application in Germany.) January 31st. (Complete.)

2,510. "Improvements in the art of rejuvenating storage batteries." A. O. TATE. February 1st. (Complete.)

2,513. "Improvements in the art of regenerating storage batteries." A. O. TATE. February 1st. (Complete.)

2,525. "Improvements in and relating to dynamo-electric machines, particularly applicable for igniting purposes in connection with internal combustion engines." A. H. MIDGLEY and C. A. VANDERVELL. February 1st.

2,542. "Improvements relating to electric circuit-breakers, switches and the like." BRITISH THOMSON-HOUSTON CO., LTD., H. E. BRITTON and H. C. HASTINGS. February 1st.

2,556. "Contrivance for enabling it to be proved that electric lamps have been utilised." S. KLEIN. February 1st. (Complete.)

2,558. "Improvements in reversible variable speed dynamos." H. LEITNER. February 1st.

2,585. "Electric lamp pendant springs and the like." A. W. SPARKES. February 2nd.

2,608. "Improvements in telephone exchanges." SIEMENS & HALSKE AKT-GES. (Date applied for under International Convention, February 12th, 1909, being date of application in Germany.) February 2nd. (Complete.)

2,638. "Improved electrical device for transmitting to a distance continuous or intermittent angular movements." F. SPALAZZI. (Application for Patent of Addition to No. 11,338, 1909.) (Date applied for under Sec. 91 of the Act, September 18th, 1909, being date of application in Italy.) February 2nd. (Complete.)

2,662. "Improvements in and relating to electric railway switches." H. W. SHERRY. February 2nd. (Complete.)

2,700. "Improved transmission for petrol-electric and electric vehicles." W. A. STEVENS. February 3rd.

2,726. "Improvements in frequency meters for measuring the speed of vehicles." SIEMENS BROS. & Co., LTD. (Siemens & Halske Akt.-Ges., Germany.) (Complete.)

2,748. "Improvements in electric switches." ADAMS MANUFACTURING CO., LTD. (Cutler Hammer Manufacturing Co., United States.) February 3rd. (Complete.)

2,749. "Improvements in rheostats." ADAMS MANUFACTURING CO., LTD. (Cutler Hammer Manufacturing Co., United States.) February 3rd. (Complete.)

2,764. "Improvements in rotary converters or other generators as used in electric welding by alternating current or for other purposes." S. JEVONS and V. D. GREEN. February 3rd.

2,790. "New or improved safety assuring holder for electric lamps and or shades." C. WHEATLAND. February 4th.

2,807. "Telephone lock clip." C. SANDY. February 4th.

2,810. "Automatic method of and means for controlling the points of electric tramways and railways." B. HENRARD and L. LEVEQUE. February 4th. (Complete.)

2,814. "Improvements in unipolar turbo-dynamos." O. SCHULZ. (Date applied for under Rule 13, April 4th, 1909. An invention comprised in application No. 2,755, dated February 4th, 1909.) February 4th. (Complete.)

2,824. "Improvements in electromagnetic apparatus for burglar alarm and like systems." A. BLOCH. (Date applied for under Rule 13, October 20th, 1909. An invention comprised in Application No. 24,076, dated October 20th, 1909.)

2,829. "Improvements in electric heat conserving, heating and cooking apparatus." G. G. BELL. February 4th.

2,831. "Improvements in electric lamps." J. B. QUAIN and C. L. TRUE. February 4th.

2,883. "Improvements in or relating to magneto machines for internal-combustion motors." ETABLISSEMENTS DE DION BOUTON (SOC. ANON.). (Date applied for under Sec. 91 of the Act, February 6th, 1909, being date of application in France.) February 5th. (Complete.)

2,890. "Improvements in electrical elements." H. B. BINKS and N. MAYER. February 5th. (Complete.)

2,899. "Improvements in insulating devices." J. STEYNIS. February 5th.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1909.

SYSTEM OF AND APPARATUS FOR REGULATING OR MAINTAINING A CONSTANT VOLTAGE IN THE CIRCUITS OF ELECTRIC LIGHTING, HEATING, OR OTHER SYSTEMS. A. Craven. 442. January 7th.

DYNAMO-ELECTRIC MACHINES. M. Walker. 693. January 11th.

ELECTRICAL APPARATUS FOR CONTROLLING THE SIGHTING OF GUNS. A. T. Dawson and G. T. Buckham. 981. January 14th.

TELEPHONE SERVICE METERS. O. C. Dennis. 986. January 14th.

AXLE-BOXES OF ELECTRICALLY-PROPELLED CARS RUNNING ON RAILS. G. J. Conaty. 1,031. January 15th.

HIGH-TENSION MAGNETO-ELECTRIC APPARATUS. F. R. Simms and Simms Manufacturing Co. 1,263. January 18th.

ELECTRIC DRIVING MECHANISM FOR CLOCKS. W. Schröder. 2,596. February 3rd.

MECHANISM FOR HYDRAULICALLY CONTROLLING PARTS, LIKE VALVES, IGNITION DEVICES, OR DETENTS. Firm of Bachrich & Co. 2,339. February 6th. (Date applied for under International Convention, February 8th, 1908. Application for Patent of Addition to No. 23,361/1908.)

APPARATUS FOR THE PRODUCTION OF ELECTRIC POWER. P. C. Day and B. Wiesengrund. 6,317. March 17th.

ELECTROLYTIC CELLS. British Thomson-Houston Co. (General Electric Co.) 6,372. March 22nd.

DYNAMO-ELECTRIC MACHINES FOR OPERATING SEARCHLIGHTS AND THE LIKE. Siemens Bros. Dynamo Works and M. Kloss. 6,949. March 23rd.

ELECTRIC PREPAYMENT METER MECHANISM AND THE LIKE, EMBRACING A WARNING OR ALARM SWITCH. J. H. Bowden, J. A. Robinson and A. H. Jacks. 7,006. March 23rd.

ARMOURED CONDUCTORS FOR PORTABLE ELECTRICAL APPLIANCES. W. Schmahl and Armorduct Manufacturing Co. 7,706. April 3rd.

ELECTRIC JUNCTION-BOXES AND CONDUIT INSPECTION FITTINGS. W. Schmahl. 9,971. April 27th.

MEANS FOR JOINING THE ENDS OF SUBMARINE OR OTHER TELEGRAPHIC AND LIKE CABLES. J. F. Dyson. 10,052. April 28th.

ELECTRIC INSULATORS. Bullers, Ltd., and H. Dagnall. 12,477. May 26th.

CONTROLLING MECHANISM FOR ELECTRIC MOTORS. W. E. Lake. (F. Bissel Co., U.S.) 13,734. June 11th. (Date applied for under Rule 13, January 12th, 1909.)

AUTOMATIC SELECTIVE SWITCHING APPARATUS SUITABLE FOR USE IN TELEPHONE EXCHANGES. F. R. McBerty. 20,839. September 11th. (Date applied for under International Convention, September 11th, 1908.)

ILLUMINATION OF LOOMS BY MEANS OF ELECTRIC LAMPS. A. C. Koechlin. 23,125. September 28th. (Date applied for under International Convention, July 16th, 1909.)

TELEPHONE EXCHANGES. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 23,310. October 12th. (Application for Patent of Addition to No. 14,239/1909.

MINE EXPLODERS. Sterling Telephone and Electric Co. (Schaffler & Co.) 24,469. October 25th.

CURRENT COLLECTOR FOR ELECTRICALLY-PROPELLED VEHICLES. W. Köhler. 26,347. November 18th. (Date applied for under International Convention, May 1st, 1909.)

CURRENT COLLECTORS FOR ELECTRIC TRACTION. W. Köhler. 25,807. November 20th. (Date applied for under International Convention, May 3rd, 1909.)

DYNAMO-ELECTRIC MACHINES. M. Walker. 29,376. December 15th. (Date applied for under Rule 13, January 11th, 1909.)

Quick Work.—MESSRS. BAYLISS, JONES & BAYLISS, LTD., of Wolverhampton, who had their power station completely destroyed by fire on Saturday night, February 5th, bringing a total H.P. of 2,000 in motors to a standstill, have in seven days been able to restart the whole of the works, an engineering feat which reflects the greatest credit upon Mr. W. E. Bryce, M.I.M.E., the chief engineer, and Mr. W. Smith, the chief electrician, and their staff. Working night and day, they cleared an adjacent building, installed 1,000 KW. in converters, erected and equipped new high and low-tension switchboards, and laid and jointed overhead and underground cables to the new station. The converters, a 500-KW. La Cour and a 500-KW. E.C.C., were loaned by Mr. Shawfield, the Wolverhampton Corporation's chief engineer, the whole being put to work and running under test on Saturday, the 12th inst.